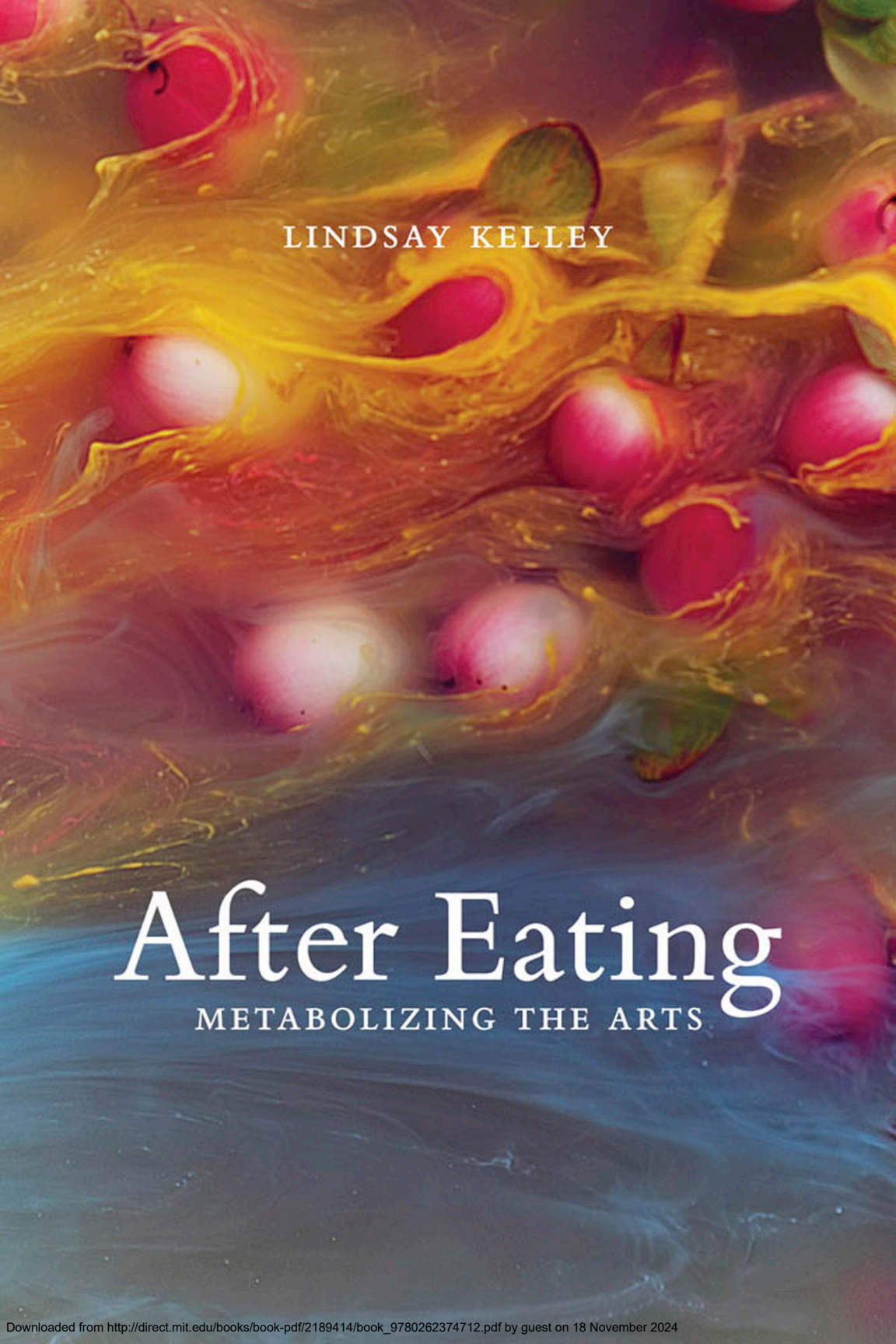


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# After Eating

## Metabolizing the Arts

Lindsay Kelley

The MIT Press
Cambridge, Massachusetts
London, England

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To the Poppies and networks of friendship

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# Series Foreword

Leonardo/The International Society for the Arts, Sciences and Technology fosters transformation at the nexus of art, science, and technology because complex problems require creative solutions. The Leonardo Book Series shares these aims of artistic and scientific experimentation, and publishes books to define problems and discover solutions, to critique old knowledge and create the new.

In the early twentieth century, the arts and sciences seemed to interact instinctively. Modern art and modern poetry were automatically associated with relativity and quantum physics, as if the two were expressions of a single Zeitgeist. At the end of the Second World War, once again it seemed perfectly clear that avant-garde artists, architects, and social planners would join cyberneticists and information theorists to address the problems of the new world order and to create new ways of depicting and understanding its complexity through shared experiences of elegance and experiment. Throughout the twentieth century, the modern constantly mixed art and science.

In the twenty-first century, though, we are no longer modern but contemporary, and now the wedge between art and science that C. P. Snow saw emerging in the 1950s has turned into a culture war. Governments prefer science to arts education, yet stand accused of ignoring or manipulating science. The arts struggle to justify themselves in terms of economic or communicative efficiency that devalues their highest aspirations. And yet never before have artists, scientists, and technologists worked together so closely to create individual and collective works of cultural power and intellectual grace. Leonardo looks beyond predicting

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dangers and challenges, beyond even planning for the unpredictable. The series publishes books that are both timely and of enduring value—books that address the perils of our time, while also exploring new forms of beauty and understanding.

Seán Cubitt, Editor-in-Chief, Leonardo Book Series

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# Introduction: A Metabolic Reading of *Mutaflor*

What happens after eating? When does food stop being food and start being a body? Everyday eating and ritualized dining shape our senses while producing subjects and social bodies. Food long ago entered museums, galleries, and public art spaces, carrying the reciprocities of feeding, lure of serving, and expectations of participation.[1] But rarely do eaters consider food after chewing, swallowing, and carrying it away in the guts of stomachs and intestinal networks. What does, in fact, happen after eating? Under ideal conditions, food disappears from the visual field. Ideal conditions may not prevail. Food might return to sight. Transformed by movement of the teeth, saliva, and stomach acids, waves of peristaltic contractions push, convey, or reverse matter out of bodies. These hidden processes are unpredictable and sculptural. Bodies shape and transform themselves at imperceptible scales. The visual and performing arts have long grappled with how the senses capture and release body processes. *After Eating* claims digestion and metabolism as key cultural, creative, and political processes.[2]

With roots in the Greek *μεταβολή* (change) and *βάλλειν* (throw), "metabolism" suggests movement, unfolding, casting, and releasing. Metabolism describes the energies created and exchanged by the cells of every living thing on the planet, from bacteria to plants to mammals to waterways. Plant energies are different from bacteria energies and different again from animal energies.[3] These differences form permeable membranes between spaces, entities, and environments. Metabolic permeability challenges humanist boundaries that police the lives of animals, ecosystems, bacteria, and even weather events.[4]

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*After Eating* has two parts. The first part focuses on "Feminist Diets," asking about the sociocultural implications of moving from body image to body process in body art from the 1970s to the present. The second part, "Giant Creatures," connects body boundaries with planetary and multispecies body processes. I develop metabolic reading as a methodology for two reasons. First, metabolic readings allow me to think with specific artists and works to challenge status quo, patriarchal, and humanist frameworks. Second, metabolic readings rethink feminist, queer, bioart, installation, and performance projects as networked research sites for rendering postindustrial and antiextractionist theories sensible and tangible. Metabolism offers a different way to read and write about art. Metabolic readings shape the space formed after eating and mark the transits of food between nutrition, embodiment, and culture.

I start with a peripatetic metabolic reading of feminist video artist Pipilotti Rist's *Mutaflor* (1996).[5] Composed in short, breathless, and repeating circular loops, *Mutaflor* maps intervals and spaces of digestion and metabolism. Approaching a naked woman, smiling as she tumbles toward sitting on the ground, a camera arcs through her open mouth into darkness, emerging from the wrinkles and hairs of her anus, the same color as her tongue. After the camera travels up the pale expanse of her back, she ingests it again and again. With each quick repetition, each repetition different, her eyes open as wide as her mouth. After several loops, she picks up a lime from the croissants and citrus fruit scattered on the floor around her, and tucks it against her vagina to isolate the purple-dark passage between mouth and anus.

A cut between mouth and asshole punctuates each loop of the camera and loop of the video. Inside this splice, the chemical and mechanical activities of the alimentary canal sort out what nourishes, what to store, and what to discard. The cut black boxes everything that happens between tongue and anus. Marking intervals, cycles, and repetitions, edits drop through and conceal the viscera and pathways that would complicate the pleasures of a system based only on inputs and outputs.

Eating the camera with *Mutaflor* shifts from body image to body process. The subset of feminist, queer, bioart, installation, and performance projects gathered in these pages form a branching pathway from body image to body process. Countless other configurations and compositions

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of metabolic arts have unfolded, are unfolding, and remain to be charted. "Bioart" refers to art that takes its materials, methods, and situations from biology laboratories. These could range from large institutions to do-it-yourself (DIY) or do-it-together biohacking or domestic settings, including kitchens.[6] Bioart more broadly refers to methods and materials that manipulate flesh, expansively construed, as art material.

Metabolic readings are already active in and around the arts. Work environments, methods, and collective making practices often give rise to metabolic awareness. Rist constructs a metabolic reading of her work environment when she discusses her collaborative work with the Rist Sisters Corporation, "a small, serious company" that is also "a self-sufficient spaceship."[7] She likely operates the camera in *Mutaflor*, following a woman who cannot be filming herself while moving in the two-armed way she moves. But attributing specific tasks to Rist undermines the workshop-to-spaceship symbiosis Rist cultivates. The spaceship's collaboratively produced works allow Rist supported access to every aspect of production and distribution. She is behind the camera, in front of the camera, and in familial and community relation with everyone involved in the production. This collective has prepared and tested the large-scale immersive installation spaces that characterize the corporation's recent practice. The Rist Sisters Corporation spaceship reminds me of feminist scholar Sara Ahmed's "killjoy survival kit," which contains an idiosyncratic and personal array of texts, objects, foods, and other sustenance: everything a killjoy might need.[8] Being a killjoy means being "willful," resisting; "she stops the smooth flow of communication."[9] I turn to metabolism to kill the joy of humanist and patriarchal ways of making and thinking, similar to how Rist stops the flow and kills the joy of commercial film production work environments. She does this through symbiosis, "sharing life history" with each video as well as each constellation of objects, lights, and projections.[10] Ahmed's killjoy survival kit will return throughout these pages—pages in which I share life history with a spaceship full of practitioners who are making things that compel me to make things.

Vocabularies of food and eating have become nuanced and sophisticated, but digestion and metabolism are usually described either with colloquial language about everyday bodily situations (gaining or losing weight, pooping, bloating, farting) or with the technical language

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of biochemistry (anabolic and catabolic pathways, cellular respiration, phosphate bonds). Mechanical approaches to bodies, including black boxes, can be traced back to metabolism's nineteenth-century origins. The calorie, body mass index, energy balance equation, and models of the stomach as engine emerge from "an industrial era, focused on the conversion of matter from the raw materials of nature to the products of man," writes scholar Hannah Landecker. Her work on the political implications of metabolism as both historical artifact and active agent remaking the world informs and inspires my metabolic reading methods in and for art theory. Landecker continues, writing that "metabolism was understood as a factory."[11] It is a factory so complex, it could hardly be understood—and metabolism continues to be difficult to understand. If metabolism is a factory, so are bodies and ecosystems, and so is life itself.

Opening the black box of metabolism reveals experimental apparatuses, the knowledges such mechanisms form, and a cartographic impulse to chart and map chemical reactions and pathways.[12] Tools for measuring factory metabolisms include the bomb and coffee cup calorimeters. Each measures energy transfer using fire and water, respectively. The bomb calorimeter evokes Rist's pitch-black interval, its walls matte and dark after absorbing fire and light from the food and organic material scorched within its heavy metal body. When I visited the Duboscq-Leitz bomb calorimeter used by scientists Frederick Banting and Charles Best to isolate insulin at the University of Toronto, I imagined its smell while peering through the wall of its sterile glass enclosure. How does this imagined smell relate to insulin and diabetes? How and what do bodies burn?

Charts of reactions and pathways use mapping and cartography to peer into metabolism's black box. In 1962, biochemist Gerhard Michal plotted all known biochemical pathways and enzymes, producing a poster-size map. The map soon expanded beyond poster size and split in two. The poster could be folded up, slipped away, and turned into a paper cut not unlike Rist's film splice. The poster cannot step outside industrial frameworks any more than metabolism itself can. The static chart resembles a massive network of entangled transit systems: a circuit, a city, or an assembly line. Soon, two posters were not enough space for charting attempts to navigate metabolism from above.[13] The Roche

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map wants to contain every possible flow, shape, and color coding, and also contains the impossibility of comprehensiveness or even comprehension. Because "our knowledge of biochemistry doubles every five years, the development of *Biochemical Pathways* is truly never ending."[14] When known pathways surpassed the two-poster format, the map moved online, and can now be navigated with search strings and filters. Map becomes interface.

Maps link conceptual worldviews with specific patches of earth, with the ground. *Mutaflor* grounds itself multiply: the camera careens toward the floor, the woman crouches in a backward-tumbling posture, the floorboards rise to meet her, and the croissants and citrus scatter around her bare feet. These downward pulls exaggerate and anchor the video's installation. Always projected on the floor, *Mutaflor* makes either neat rectangles or skewed and dynamic trapezoids. Curatorial direction has placed *Mutaflor* on the floor with portraits on the walls, squares, and different scales bouncing across and between one another. Sometimes *Mutaflor* occupies a hallway or transition space, forcing visitors to cast their shadows and bodies over and through the woman's lipsticked open mouth or shadowed asshole.

Questions about scale and trace arise when working from and projecting onto the ground. Thinking metabolism with *Mutaflor* invites scale shifts, from cell to body, body to cell, planet to ecosystem, cell to ecosystem, and ecosystem to planet. For mammals, metabolism is both bigger and smaller than digestion. Metabolism is bigger because it activates every process that breaks down, maintains, and creates an organism's bodily matter. It is smaller because it unfolds within cells, while digestion occurs in the digestive organs, which are made up of some of the trillions of cells that compose a body. Metabolism and digestion share space, but that space changes, reshapes, and reorients in the same way that projections change size and dimensions. As visitors walk across the projection, they walk into and through the woman's open mouth and dark insides. "Rist has been devoted to exploring how to extend and enlarge spatial limits," writes scholar Peggy Phelan. "Her work makes room for interior images, emotions, dreams and all that is usually edited out of external images."[15] As a mirror for the bodies of visitors, *Mutaflor*'s projected mouth becomes a giant creature, or a comparably sized one, depending

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on the site. Working from the ground, Rist holds size, angle, and scale in tension.[16] Bodies fall into other bodies.

And bodies change. The legacies of industrial metabolism linger in sociocultural life and return in cutting-edge metabolism research. This new biology includes epigenetics, which studies how environmental factors impact how genes work, and microbiome research, which accounts for symbiotic and pathogenic microbes that influence everything from digestion to immune response. Even though the epigenome and microbiome seem to challenge or even undermine industrial frameworks for metabolism, Landecker reminds us that the bodies, environments, and microbes studied by contemporary metabolism researchers are bodies, environments, and microbes produced by and living the consequences of industrialization. She describes a "new metabolism" characterized by permeability; instead of fuel, food becomes environment.[17] Remembering the Roche map, metabolism becomes more interface than factory.[18] Figuring metabolism as interface allows Landecker to consider the "aftermath" of categorical differences between metabolism and reproduction.[19] This collapse interferes with some of the disciplinary separations that have historically defined biology as a field of practice.

*Mutaflor* moves in "metabolic loops and spirals."[20] When the woman eats Rist's camera, she eats her environment. The camera creates the room and the world around her, and eating the camera eats the world. But does shitting the camera dispose of the world, or, given the loop back to the mouth, does shitting the camera nourish the world?[21] Together with discard studies and research on the circular economy, interface metabolisms connect and reveal waste and fecal matter's communicative and cultural capacities.[22] The camera loops and spirals; a body, crouching, tumbling, falling, catching itself, loops and spirals; and the cut splices relentlessly: a metronome with multiple, unsteady, and differing intervals. Each loop changes. There is no first or last loop. Sealing the vagina with citrus punctuates but does not resolve the looping. Scholar Annemarie Mol folds metabolic loops and spirals into a "painful" discussion of how sanitation practices, especially flushing waste down the toilet, reveal the material consequences of the industrial and colonial violence that continue to produce human exceptionalism. Mol's work on "eating bodies" along with her careful ethnographies of eating across medical, domestic, and

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philosophical arenas are another touchstone for this book. I gratefully take up Mol's invitation to "run with" her "interferences" into hierarchies and exceptionalisms.[23]

After the woman eats Rist's camera, *Mutaflor* withholds the familiar endoscopic view of body interiors. Some would expect to see the lining of the throat, gut, and bowel, which can be perceived in varying formats and quality thanks to the "prosthetic vision" offered by medical imaging technologies.[24] Instead of the blip of a black box, what if the cut between throat and asshole becomes the blip of process engulfing image? Withholding the endoscopic view invites sensory expansion. The shadows between and inside mouths and assholes show the rich presence of all colors, not the ominous absence of color. Each loop from mouth to anus dives inward and spins outward, compiling a dizzying roster of breaking down, building up, and reproducing forms, relationships, and politics. As metabolism and reproduction become increasingly indistinct, feminist worries about the *image* of visceral and base bodily functions potentially ease. No longer mindless matter burned for fuel or appearance's sake, food becomes a decision-making *process* that unfolds across generations. The black box opens, revealing unexpected cross-disciplinary alliances and infections.

But how to stop feeling like an engine, counting calories while tethered to a Fitbit? How to integrate knowledge that nutrition has intergenerational effects? How to communicate with microbiota instead of flushing away their efforts? How to resist relating to bodies as extractive zones? Postindustrial metabolism research and art that center intimacy and reciprocity each differently resonate with scholar Warren Cariou's articulation of "energy intimacy" and scholar Macarena Gómez-Barris's "interstices of resistance within the extractive zone."[25] Responsive and sensorily attuned metabolic reading practices must avoid appropriating First Nations ontologies while remaining mindful of metabolism's industrial beginnings and connections between industry and longer histories of ongoing colonial violence.[26]

Increasingly artists and theorists turn to questions about entanglement and relationality in their search for antiextractive paradigms anchored in culturally appropriate terms. Digestion and metabolism have mattered to their research. Asking what happens after eating begs the

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related question, What happens after activist and philosophical notions of entanglement?[27] Networks of relations and entangled matter resemble a stomach full of food. By breaking down these networks and connections, reassembling them, moving them along, creating new substances, and separating what cannot be assimilated, metabolic readings offer tactics for acting within entanglements and relations that do not deny their nuance and intricacy. The more hopeless orientations toward these relations are described by philosopher Alexis Shotwell as "the despair that can arise from complexity."[28] This despair links to broader critiques of and resistances to extractive modalities inherited from industrialization. These critiques have created a field of enmeshments so rich with possibilities that many are asking how to move through these dense networks. Postgrowth politics shift away from extractive models. Metabolic reading practices can help navigate "mangles of practice" and "implosions" by, as with the Roche map, rendering networks *more* rather than less complex.[29]

Art and metabolism research share processes of making, unmaking, and transforming matter, prioritizing immersion and encounter over distant observation. Metabolisms model this inextricability. Homeostasis can only be achieved by activating connections. As with *Mutaflor*'s precarious tumbling balance and posture, sitting back and watching will tip the system out of balance. Research-creation emerges for scholar Stephanie Springgay as "the complex intersection of art practice, theoretical concepts, and research . . . attuned to processes rather than the communication of outputs or products."[30] Vocabularies of research-creation resist the dominant impulse to regard artists and artworks as objects to be studied. Metabolic readings similarly exceed roles for art that would limit its work to illustrating concepts or communicating the results of other studies. Instead, art practice makes its own theoretical and experimental antidisciplinary contributions. Describing art's capacity to create and address transdisciplinary research questions, artist and scholar Natalie Loveless commits to "mobilizing research-creation as a way to develop work that is not simply *on* ecological topics but that takes ecological *form*—not just *on* but *as*."[31] Research-creation and related vocabularies, including scholar Kat Jungnickel's "making things to make sense of things," join Landecker's histories and Mol's eating bodies to open more pathways for metabolic readings.[32] Metabolism moves beyond the cell to become a method

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for responding to the contemporary moment's most difficult cultural, philosophical, and political challenges.[33]

The syncretic, intergenerational, and cyclic capacities of the arts stage tangible encounters between species, bodies, and environments. Cultivating a neglected middle ground between scientific results and research-creation activations, metabolic readings ask art history and theory to account for how biomaterials and body processes enter sociocultural life. From public diets to interspecies gestation to crocheted ecosystems, research-creation and postindustrial methods traverse practice and theory to confront the transgression of theoretical categories that have historically divided body from world, metabolism from reproduction, and science from art. Sensorily immersive performance and installation spaces produce the kinds of subjectivities and engaged publics that scientific findings will soon depend on to be understood.

These tangible encounters arise from and provoke embodied sensation. Like bodies, embodied sensations and "memories of the senses" carry politics.[34] Factory metaphors for bodies are considered "common sense" in many cultures, including my own. I grew up in the United States with an instrumental understanding of nutrition, calories, and diet supported by my school curriculum, which included home economics and nutrition, and government dietary guidelines.[35] Today, "common sense" refers to the practical judgments or shared understandings that support my ability to find mainstream logics of calories, weight, and body shape intuitive and unremarkable ways to relate to food and eating. Although the term no longer describes embodied, felt sensations, "common sense" retains the potential for a "socially forged sensory composition of a world."[36]

A bodily understanding of common sense died out in the seventeenth century as "the consolidation of individualism and of the individuation of the senses proceeded apace in the eighteenth and nineteenth centuries." Scholars David Howes and Constance Classen go on to explain how this "'dissection' of the sensorium" aligned with industrialization.[37] Industrialization in turn produced the invention and study of metabolism, the tragedy of the commons, and the rendering of organisms as engines burning food as fuel. The five-sense framework mechanizes, oppresses, quantifies, and instrumentalizes shared, diffuse, and ambiguous processes, privileging distance over situatedness.[38] Industrial black

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boxes are at once empty of and filled with the preindustrial crossmodal "common sense," "common sensibles," or "*Gemeingefühl*, 'common sensation.'"[39]

Metabolism's industrial origins are not a coincidence. Some of the reasons the senses are political have to do with industrialization's follow-on effects as well as links between plantations and factories, colonization and oppression, First Nations struggles for environmental justice, and the complexities and limitations of Anthropocene discourse.[40] Metabolic readings acknowledge the urgent political stakes that inform sensory experiences of food art.[41] Exceeding individual perception, the sensory takes cultural form, compelling bodies to become collectives.

Regarding Mutaflor-the-probiotic as an actor in Rist's *Mutaflor* helps me understand how some of the dissected senses that emerged from industrialization capture the diffuse embodied feelings once called common sense. Sensations that compel probiotic use (bloating, discomfort, and constipation) suggest "interoception," a word that articulates internal physical and emotional states by gathering everything from the condition of the nervous system to emotions to hunger pangs.[42] A body might detect a need for probiotics through "visceroception," which refers to sensations of the soft organs—the heart, digestive organs, and lungs. The visceral sensory system has anatomically distinct afferent neurons that produce unique sensations.[43] Relevant to Rist's camera tumbling and falling to the ground with the wide-eyed woman, "proprioception" describes the awareness of the body in space, while "kinesthesia" captures an awareness of bodily movement. Without functional proprioception and kinesthesia, the woman would not be able to catch herself from falling. Diffuse and difficult to split sensations unfold after seeing, after touching, after tasting, after smelling, after listening, and after eating. These are situated processes of digesting, living, moving, and metabolizing.

The commercially available Mutaflor probiotic contains *Escherichia coli* strain Nissle 1917, named for its use by physician Alfred Nissle during the First World War. One of the soldiers in his care remained healthy during a dysentery outbreak, and *E. coli* isolated from his feces helped others recover.[44] From the Latin *mutare flora*, *Mutaflor*'s title signals a changing microbiome, a gut moving through the wide-eyed loops and cycles that propel Rist's camera. *Mutaflor*'s dark cuts and pulses make digestion's

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internal time and space opaque, private, unseen, and everywhere. In the shadows of digestion and metabolism, visceral sensations feel what cannot be seen without recourse to the intruding endoscope that Rist withholds from the video's looping path around and through the woman's body. Each blip marks a temporal transit through body and viscera, enclosing this cyclic process in another black box.

Unconscious sensory sympathy may become conscious aesthetic awareness. In 1974, artist Carolee Schneemann wrote, "I assume the senses crave sources of maximum information."[45] Observing the temporal transits and movements of feminist, queer, bioart, installation, and performance projects transmits these acute, maximal sensations, even to bodies at rest. Moving more deeply into *Mutaflor*'s cut between mouth and anus, I wonder how to extend philosopher Barbara Montero's work on dance performance and its capacity to register "proprioceptive information" across performer and observer bodies.[46] Montero's "aesthetic sense" does not refer to judgment or perceived beauty but instead suggests "the disposition to sense acutely."[47] Watching *Mutaflor* accesses such dispositions. Spectators proprioceptively, simultaneously, and maximally sense the posture of the woman's body, the smell of citrus and croissants, the texture of the floorboards against bare hands, calves, and feet, and their own embodied "ecological condition" or "ecocultural identity."[48] Noticing proprioception when observing bodies shifts an unconscious response into a conscious one. Schneemann describes this as a capacious craving and longing that artists, art audiences, and participants have to "enlarge their kinesthetic field of participation."[49]

Just offstage from Montero's proprioceiving dance audiences, shared sensory attunements unfold within a taste laboratory.[50] Showing how "downgraded" sensations can still be shared, panels of trained participants "coordinate their palettes."[51] These shared and aestheticized experiences of smell recall perfumers training their noses to recognize subtle olfactory differences.[52] Each of these work environments or symbiotic spaceships has its own culture, practices, conventions, and therefore politics. What follows? After eating and entrainment, the senses edit bodies. Sensory studies has established the ability of the senses to "disrupt the presumption of the unity of the body."[53] This disrupted body loops downward and tumbles into scholar Donna Haraway's spatialized, hyphenated, troubled

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"material-semiotic nodes or knots."[54] Haraway's figures thread through and across each chapter, leaving impressions on the fingers forming her supportive cat's cradles.

*After Eating* dwells within the possibility that metabolism's sociocultural contributions have taken the place formerly occupied by the common sense. Visceral and squishy internal spaces join an atmospheric and breathed "aesthetic experience of metabolic processes."[55] Although she stops short of explicitly defining metabolism as the common sense returned, Mol asks, "What if we were to stop celebrating 'the human's' cognitive reflections *about* the world and take our cues instead from human metabolic engagements *with* the world?"[56] What if people are digesters as much as they are thinkers? Phenomenological questions would change if approached through not only the mouth but also the guts and bowel. Mol writes, "While, as a walker, I move through the world, when I eat, it is the world that moves through me."[57] This shift from a body moving through a world to a world moving through a body reorganizes sensoriums by undermining factory frameworks for metabolism. As an ocean moves through corals, other species and mobilities sink and swim, invoking scholar Astrida Neimanis's bodies of water, slippery figures floating through these chapters.[58] When worlds move through bodies, bodies struggle to be exceptional or extractive.

Where does food go after eating? Do eating bodies seek sensation on the tongue, sensation in the bowel, or maximal sensations connected to vast planetary cycles? An activist vanguard working from the gut has started to repair the damaged common sense. Metabolic readings collaborate with and contribute to scientific findings and theoretical concepts from science and technology studies.[59] Feminist, queer, bioart, installation, and performance projects emerging from art-science knots and nodes refuse efforts to contain art within the boundaries of science communication or illustration. Whether framed as transdisciplinary "infection," a "third culture," or "boundary conditions," the arts reveal links between metabolic processes and the dynamic social and cultural complexities of bodily and cellular life.[60] Metabolism helps artists make, think, write—and eat—about art.

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# I

# Feminist Diets

What if body art organized itself around body process instead of body image? How might such a shift politicize sensation and embodiment? The three chapters in this part offer metabolic readings of canonical and more recent performance art practices. These projects engage feminist diets and dieting feminists to analyze how fleshy and social bodies are nourished by feminisms. Chapter 1, "Stuff Change: Body Image to Body Process," considers the relationship between metabolic balance and feminist struggles to reconcile body image with body process. Focusing on one such body process, chapter 2, "Food Babies," reads sensations of digestion and reproduction against one another in the wake of a collapse between metabolism and reproduction in biology. After eating, food both shapes bodies and creates an environment for growing wanted and unwanted things (flesh, tumors, fetuses). Chapter 3, "Eggs, Kale, Cancer, Fertility," follows wanted and unwanted flesh and growth to offer a metabolic reading of cancer and fertility diets. Complex polluted links between food, cancer, fertility, and queer, feminist practices of care challenge calls for individual dietary change in the face of environmental toxicity. Throughout this part of the book, activities of digestion and metabolism question the boundaries of food, reproduction, and growth. Feminist diets connect cultural and cellular life.

Remembering scholar Sara Ahmed's "killjoy survival kit," I wonder with Ahmed how "feminism too can be thought of as a diet; a feminist diet is how we are nourished by feminism."[1] How *are* feminist, queer, bioart, installation, and performance projects nourished by feminist theory and social movements? When reading diet, exercise, and body shape, centering body processes shifts body as object to body as process,

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interface, or ecology. Metabolism offers a different type of reading practice in and for art theory.

Body art in the 1970s and 1980s developed radical methods for confounding subject/object relations as well as complicating and undermining sociocultural norms. As these practices are remade and reflected on by performance artists working in the 1970s, 1980s, and today, body art becomes a compelling site for understanding bodies as sensory interfaces and multispecies ensembles that are always transforming. Reading body art in this way is not new; artists have consistently developed and articulated metabolic methods to critique how body, metabolism, and society bounce between and through one another.

Dieting for weight loss focuses on the *not* eaten and *not* processed, on absence and lack. With Ahmed as an important exception, the literature on "feminist diets" usually places "diet" adjacent to weight loss. The question "Can a feminist diet?" often refers to psychotherapist Susie Orbach's book *Fat Is a Feminist Issue*.[2] Although fat is undoubtedly a feminist issue, scholar Natalie Jovanovski critiques how Orbach's 1978 book "unintentionally reinforces body-policing narratives."[3] Instead of portraying diet as nourishment, environment, or adaptation, weight loss frameworks simplify or ignore the complexity of metabolic processes. As scholar Silvia Federici insists, "changing our body . . . is to change the material conditions of our lives."[4] When certain changes are labeled "feminist" and other changes are labeled "antifeminist," body images bind feminisms to rigid, intractable, and punishing patriarchal structures and systems. This part of *After Eating* asks how the extended energy deficits endured by so many may have influenced and constrained queer, feminist body art and theory. Metabolic processes are material processes, and never unfold in isolation. In solidarity with Ahmed's killjoy survival kit, the texts and practices in these chapters feed and starve body processes by killing the joy of body images.

Metabolic readings of works made by artists Alison Knowles and Felix Gonzalez-Torres offer different methods for moving between body image and body process. In Knowles's *Make a Salad* (1962), the title becomes an event score. Knowles, often assisted by others, makes a salad and serves it to variable numbers of people. The salads have always been large; an early *Make a Salad* at the Institute of Contemporary Art in London was

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mixed in a pickle barrel because it was too big for a regular bowl.[5] Knowles explains that when *Make a Salad* was performed in Denmark, the salad fed three hundred people, and "turned out to be a very rebellious piece, because it was performed at a concert funded by the music conservatory" and "the audience was really offended."[6] Since these first salads in the 1960s, the pickle barrel has expanded, taking flexible forms, including a large gray Rubbermaid storage tub in 2003. What may have been the largest *Make a Salad* was tossed in a giant green tarp at the Tate Modern in 2008. Knowles fed thousands of people using ingredients thrown from the bridge above the Turbine Hall. The work infiltrates audiences' everyday lives. Knowles explains that "whenever you eat a salad, you are performing the piece."[7]

In an interview with artist Linda Montano, Knowles recalls the moment when her mother began to "watch her weight" and how this changed the atmosphere at the dinner table: "She did take off the weight. It was one of her most assertive acts, and probably a good thing, but at some expense to group enjoyment."[8] Montano links this recollection to *Make a Salad* through questions about parallels between life, cooking, and art. The interview suggests that choosing to *Make a Salad* loops back to early dining experiences. Childhood meals and Knowles's mother simultaneously shrink, diminish, assert, and take form. These memories of Knowles's family table add tension to her performances. The exuberance and excess of mass salad hospitality explode the healthful and dietetic imperative of Knowles's childhood table, reinserting lost abundance, conviviality, and community.

If *Make a Salad* manifests every time I eat (rather than make) a salad, then body process and metabolic methods activate the distributed digestion that makes the performance possible. The score and performance vary even as Knowles's salad ingredients have stabilized over time. (*Variation #1 on Proposition: Make a Soup* was first staged in 1964 but was not performed as frequently as *Make a Salad* due to the time and logistics required to prepare hot soup for a crowd.) Ingredients and their preparation are in conversation with methods that appear repeatedly in her work, including daily domestic routine, participation, found and experimental sound sources, and portability. Knowles's *The Identical Lunch* (1967) evolved from the habit of eating the same lunch in the same diner

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to a collective recipe archive and then an "extended meditation, score, and journal."[9] These artistic choices and methods can only be developed after eating. Scholars Lauren Fulton and Lucia Fabio trace how Knowles's projects activate their bodies and metabolisms. Fulton writes, "Knowles's process is 'nourishing'" and "offers sustenance," while Fabio elaborates on her own experience of *Make a Salad*, describing how she "literally consumed the work, beyond its visual metaphor: the salad moved through my body as sustenance."[10] The digestive networks formed by the salad and lunch carry the performances outward to interfere with existing patterns and create intergenerational community.

Similar progressions—eating, habit, meditation, making, digesting, scoring, and marking time—inform Gonzalez-Torres's candy spill installations. A large mound of multicolored, individually wrapped hard candies spills from the corner of a white-walled gallery space. Visitors crouch down to take one. Some immediately unwrap the hard candy and pop it in their mouths; others drop it in their pocket for later. The pile diminishes over time, but the wall label assures an "endless supply."[11] Discarded wrappers accompany an epidemic of tiny sugar highs as the candies persist across the now-networked bodies of participants. Piled in a corner as in *Untitled (Portrait of Ross in L.A.)* (1991) or arranged carefully on the floor as in *Untitled (Placebo)* (1991), Gonzalez-Torres's candy spills might appear to be sculptures that use candy as their material. But the candy isn't the point. And the immediate community formed around the candy spills isn't the (whole) point either.

Digesting and metabolizing the candy activates the work. Gonzalez-Torres explains that "when the viewer takes the candy and eats it and shits . . . the candy piece at the end, . . . that is the final piece when the candy or the sweet gets eaten and then is spilt as shit from the body, that is also, you know, an ultimate collaboration, because I am actually giving energy to the body to function."[12] The candies spill from the floor and spill again from the guts. Each candy spill forms a metabolic network shared by participants. The 175-pound "ideal weight" for *Untitled (Portrait of Ross in L.A.)* stands in for Gonzalez-Torres's partner Ross Laycock's healthy body weight. A diminishing pile of candy may evoke Laycock's weight loss as he became ill and died from AIDS (in 1991, the

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year the work was first realized). A parallel metabolic reading emerges from Gonzalez-Torres's intention for the installation. The candy wrappers contain little parcels of energy that infectiously distribute vitality across hundreds of bodies. This network of sugar highs depends on the candy body's decreasing ideal weight.

Metabolizing and digesting bodies make the materials art. As with Knowles's salad ingredients, Gonzalez-Torres's candy spills cannot be mistaken for a sculpture. Digestion and metabolism build a social body with a collective common sense of what it means to make and eat candy or salad. Framing salad and candy as art matters. How else would the significance of shared candy sensations or shared salad sensations be understood? By linking the performances to a dieting mother and limited culinary palette, Montano complicates the social shape of Knowles's salads. Gonzalez-Torres shares life history with the candy spills, following glucose metabolism to map chosen family and queer community networks forming and dissolving under pandemic conditions. These lively pathways outlive Laycock and Gonzalez-Torres. By exploding tightly regulated relations, tables, recipes, and ingredients into large-scale consumption, body processes reckon with and prevail over body images. As Knowles states, by pursuing the additive process of "just getting out there and making a salad for people," then "participation is guaranteed."[13] The conviviality lost from her childhood table and its diminishing enforced diet proliferates in the digestion and metabolism of by now tens of thousands of people who have consumed *Make a Salad*.

Anyone who has made a salad knows the impossibility of dividing the experience neatly into separate senses. Does the smell of the dressing matter most, the color of lettuce, or the sounds of chopping? How to compare the crisp feeling of fresh carrots under fingers and knife with the move to toss a forgotten spongy carrot into the compost at first touch? Does the texture of radishes on the tongue matter more than their spicy taste? And can taste succeed without smell?[14] What about sensing temperature in the chill of refrigerated greens, warmth of roasted vegetables, or pain receptors activated by cayenne peppers? And how to account for the muscular coordination and body awareness required to chop and toss ingredients, whether mixed in a pickle barrel or thrown into a tarp?

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A shift from body image to body process supports the possibility of reviving a common sense. Body processes do political, crossmodal work that body image alone cannot manage. Whether Knowles's salad, Gonzalez-Torres's candy, or the kale, pizza, and pharmaceuticals ingested in upcoming chapters, postindustrial and antiextractive approaches to digestion and metabolism mobilize the senses to dismantle humanist and essentialist methods.

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# 1

# Stuff Change: Body Image to Body Process

Feminist, queer, bioart, installation, and performance projects act on and change feminist theory and feminist art histories. This chapter reverses the impulse to map theory onto art practice and considers how practice feeds theory and might feed theory differently. In this first of three chapters devoted to feminist diets, public performances of body processes undertaken by artists Faith Ringgold, Eleanor Antin, Cassils, and Rachel Herrick unsettle any easy understanding of how metabolic processes, weight, and body size map together. A metabolic reading of Ringgold and Antin's public diets must consider how long-term catabolic states inflect and inform feminist struggle. Are feminist politics on a diet? Can the public diets of artists be subversive, collective, and radical, or is diet discourse and the "dietetic imagination" intractably embedded into patriarchy?[1]

Artists undertaking public diets and public exercise regimens cannot be neatly categorized.[2] Fitness and dieting might coincide with art practice, be the purpose of art practice, or be folded into a documentary impulse that captures dieting and exercise as part of a larger life history. Metabolic reading practices complicate any possibility of neat distinctions between these catalysts. Whatever their motivation, the works in this chapter leverage art's capacity to access spaces and experiences of eating bodies. Such "projects that work *from and with* lived experience . . . perform a 'metabolising' and transformative function in relation to material that may otherwise be hard to think of and hard to bear."[3] Metabolic reading practices do not dilute or diminish challenging content but instead create focused sensory pathways through what might overwhelm or incapacitate in other contexts.

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While Ringgold and Antin were making art about losing weight in the 1970s and 1980s, the commercial diet program WeightWatchers was ascending to its peak popularity. Daily life started to include tracking points, weighing in, and compiling data about weight lost and gained and lost again. The diet industry formed alongside and because of neoliberal subjectivity, and has turned bigger and bigger profits each year.[4] Ringgold's series of three quilts, each titled *Change: Faith Ringgold's Over 100 Pound Weight Loss Performance Story Quilt* (1986–1991), and Antin's weight loss documentation installations, *Carving: A Traditional Sculpture* (1972) and *Carving: 45 Years Later* (2017), document tracked, quantified, dieting bodies through decades. They are life works, adapting and aging with their makers. Antin lost 10 pounds over 37 days in her 1972 *Carving*. She returned to the project in 2017 for 100 days of weight loss. She did not document her first 11 pounds in the 2017 *Carving* because, she says, "I was embarrassed."[5] Ringgold lost over 100 pounds out of a weight loss goal of 128 pounds. A series of quilts documents Ringgold's life history, and accompanies a performance where Ringgold sings, tells stories, and physically wrestles with her lost weight. She drags the weight around the stage as garbage bags filled with heavy water bottles. Then she casts off a bulky coat to reveal her new figure.

Metabolisms have figured explicitly in histories of sex and gender, perhaps first in 1889 when biologist Patrick Geddes and naturalist John Arthur Thompson divided metabolism's two key movements, anabolism and catabolism, into a gendered binary. They align men with catabolic reactions (disruptive and changing) and women with anabolic reactions (including constructive processes such as childbirth).[6] Contemporary fitness slogans often reverse this binarization by associating masculine bulk with anabolism. These shifts show how metabolisms are culturally and historically constructed and how the gender binary morphs but persists. A metabolic reading practice works against such blunt dualisms by considering how multispecies actors digest, cycle, excrete, reproduce the self, and reproduce generations.

Extended periods of dieting and weight loss put the body into a catabolic state, which in severe forms can progress to cachexia, where the search for nutrients leads the body to start cannibalizing its own tissues. Catabolic and anabolic pathways work together—one needs the

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other for metabolism to function. Yet one set of reactions may dominate a given metabolism, meaning that a body's relation to environment might be in a "catabolic state" or "anabolic state." Both Ringgold and Antin would have placed their bodies in long-term catabolic states to achieve the weight loss they document in *Change* and *Carving*.[7] Ringgold's metabolism would have skewed toward catabolism for years as she maintained over 100 pounds of weight loss while simultaneously developing an exercise practice and attempting to lose even more.[8] Their experiences are not exceptional or unusual. Responding to a study that found women spend an average of seventeen years of their lives on a diet, Natalie Jovanovski calls for "a subversive, collective and radical feminist consciousness around food and eating."[9] This feminist consciousness would benefit from complicating popular knowledge about metabolism and weight loss.

"Metabolism" has become shorthand for the ease or difficulty of weight loss. Metabolisms are "fast" or "slow," suggesting that metabolic pathways can be driven like a car. Collapsing metabolism into weight loss reduces biochemical reactions to a simple, formulaic energy balance equation, as seen in this article on the website Healthline: "Take catabolism (how much energy your body produces) and subtract anabolism (how much energy your body uses). If you produce more than you use, you may pack on pounds as the energy gets stored away as fat. If you use more than you produce, the opposite may happen."[10] Health and wellness writing reproduces this formula ad nauseum, sorting diets, exercises, and hormonal influences into catabolic or anabolic categories. Fitness frameworks reduce complex signals and reactions to blunt categorizations of kinds of exercise, gaining or losing muscle, body shapes, secondary sex characteristics, and ideal states.

Metabolic pathways seek balance in an imbalanced world.[11] This environmentally sensitive search for equilibrium looks nothing like the black box figured by the energy balance equation. But recent results suggest that the energy balance equation mischaracterizes exercise's contribution to metabolism. Energy expenditure peaks at one year old, decreases to "adult levels" by twenty years old, and remains at a constant level, only slowing after about age sixty.[12] No amount of exercise will change this trajectory.

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After internalizing the energy balance equation, hearing "that your daily activity level has almost no bearing on the number of calories you burn each day" feels counterintuitive.[13] This could be because metabolism has been discussed as a lever that can be pulled by a "human motor" or a "work machine."[14] Evolutionary anthropologist Herman Pontzer flips the energy balance script with findings that "our metabolism doesn't *dictate* energy balance it *responds* to energy balance."[15] Metabolisms do not create environments, but instead respond to conditions. A revised energy balance equation might read, "If you produce more than the fixed amount you use, you may pack on pounds." Popular interpretations of metabolism ignore countless additional factors contributing to health and body size, including culture, environment, intersectional identities, and psychological dynamics such as histories of trauma and abuse.[16] Art can account for culture, environment, and specific bodies. Metabolic readings develop responsive rather than dictatorial understandings of how body stuff changes.

## Changing and Carving

Ringgold started her career as a painter, and describes her textile practice as "a unique way of painting using the quilt medium."[17] She had been making story quilts for many years before *Change: Faith Ringgold's Over 100 Pound Weight Loss Performance Story Quilt*. Her quilts depict everything from her travels in Europe and Africa, to her engagement with art history, especially canonical white male artists including Pablo Picasso and Henri Matisse, to the racism of popular consumer culture, as with *Who's Afraid of Aunt Jemima?* (1983). The *Change* quilts and Ringgold's broader quilting practice enact what scholar Sidonie Smith characterizes as "an ongoing process of reading as piecing."[18] Quilting becomes painting, storytelling, and analytic framework. Quilts carry residues, shapes, and impressions of their makers and the sleepers they cover. Even in white cube gallery settings where displays cannot be touched, quilts relate to bodies.[19]

Ringgold's *Change* flows through this chapter's title, "Stuff Change," positioning *Change* within the German *Stoffwechsel*. Usually translated as "metabolism," painter Amy Sillman returns *Stoffwechsel* to English as, literally, "stuff change."[20] Metabolisms exist to create change. Each pathway

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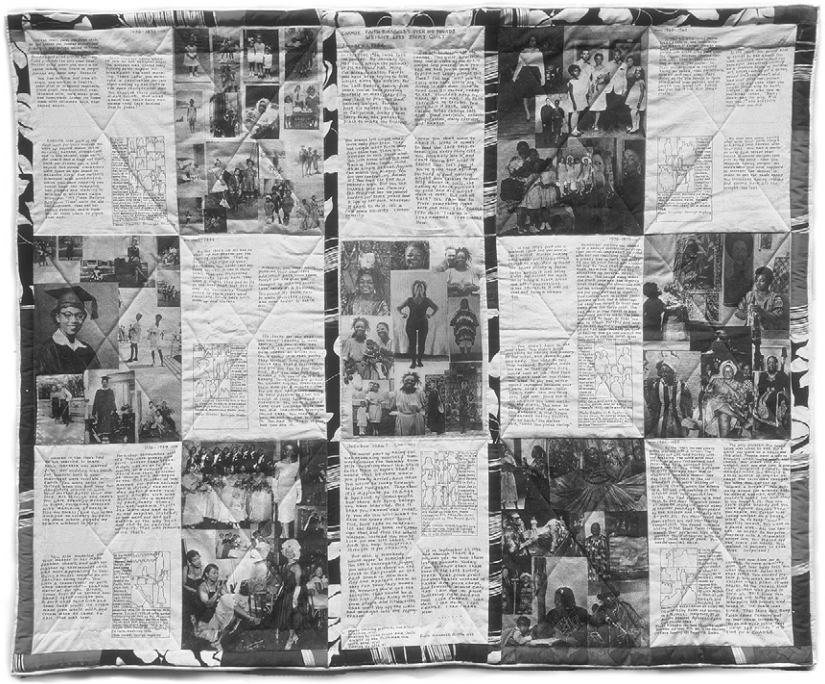

**Figure 1.1**
Faith Ringgold, *Change 1: Faith Ringgold's Over 100 Pound Weight Loss Performance Story Quilt*, 1986. Photo etching on canvas, quilt, 57.5 × 70.2 in. © 2021 Faith Ringgold / Artists Rights Society (ARS), New York, Courtesy ACA Galleries, New York.

takes in a molecule, and converts that molecule into smaller, bigger, or otherwise changed components. Complemented by a complex signaling system, each reaction sustains or feeds the following one. Although metabolic signals, pathways, and components are tiny, their effects create bodies, ecosystems, and worlds—and in Ringgold's case, quilts.

Ringgold's 1986 *Change* unfolds over fifteen panels, with bold black, white, and red borders splitting the quilt into three sections. The panels alternate between black text printed on white fabric and collages of black-and-white photos printed on fabric, marking graduations, family celebrations, and career milestones. The images and text create a checkerboard grid that echoes the bold diagonal rows of stitching. Diagonal lines cross out each panel's content even as the stitching holds the quilt together. The photo collages depict Ringgold's body at different sizes,

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but their complex, layered composition resists the "before and after" format of many weight loss representations, where "the fat person, usually a fat woman, is represented not as a person but as something encasing a person, something from which a person must escape, something that a person must cast off."[21] Ringgold's photographs resist these tropes by depicting her life in all of its complexity. The *Change* works are rigorously intersectional and holistic; Ringgold's life story and autobiography inform the works at every stage, reading weight alongside gender, race, class, and sexuality.

Quilting connects Ringgold to her mother, a fashion designer, and the cultural traditions of the Black diaspora in the United States.[22] Scholar Olga Idriss Davis recalls the revolutionary capacities of quilting for enslaved Black women: "The quilt became a covert manifestation of resistance within the context of storytelling. . . . [t]he weaving of stories into quilts became a way for Black women to defy the system of slavery." By quilting stories of freedom and liberation, Ringgold draws on "a culture of the quilt which names experience and reclaims the history of the struggles and triumphs of freedom."[23] Ringgold's quilts document intergenerational knowledge about Black lives, Black struggle, and Black joy in the Black diaspora.

Ringgold's performance practice mirrors her approach to quilting, emphasizing storytelling and community. She explains, "My performance mode was not inspired by the unfathomable art performances of the 1970s or avant-garde happenings of the 1960s, . . . but rather by the African tradition of combining storytelling, dance, music, costumes and masks into a single production"—a modality Ringgold witnessed when she visited Nigeria and Ghana in 1976.[24] When I encounter artworks and performances depicting acts of extreme effort or exertion in contemporary art spaces, I am likely to be sitting on a bench or the floor, leaning against a wall, or standing relatively still, shifting from one foot to the other but definitely not moving. My stillness marks me as an observer, not a participant. This passive spectatorship aligns with Ringgold's characterization of 1970s' performance art as "unfathomable." I watch someone exercising, breathing heavily, lifting weights, eating or not eating, but my bystander body doesn't move even when confronted by the embodied practices of performers. Body becomes image.

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In the *Change* performances, participants join Ringgold to move heavy garbage bags around the space and sing along with Ringgold's *Change Song* (the *Change 2* quilt documents the lyrics). Pulling the garbage bags produces not an "unfathomable" image but rather an invitation to both *Change* participants and all art audiences to engage questions about weight loss, diet, and strength through the shared common senses activated by participatory embodied awareness. Audiences motivate and support the work, recalling the group accountability principles at the center of the WeightWatchers program. From a distance, viewing documentation of the performance, the garbage bags represent fat. But embodied in performance and read metabolically, the weight of the garbage bags shares life history with Ringgold and connects Ringgold's body processes with those of audiences.

Passive viewing, including the museum viewing postures outlined above, can change and become active viewing by becoming attuned to proprioception, the sense of the body moving in space. Writing on dance, philosopher Barbara Montero argues that "the observer's experience of dance can be enhanced by an awareness of the bodily feeling of dance."[25] In her reading of artist Carolina Caycedo's video works centered on the Magdalena River communities in Colombia, scholar Macarena Gómez-Barris claims the term "geo-choreography": "Caycedo's geo-choreographies seek out forms of human kinesthetic movement that mimic or work alongside the motion of the river in an expression of collaboration with it."[26] As a sensory and aesthetic response, geo-choreography relates to Montero's "bodily feeling" imperative. Ringgold's choreography initiates multimodal participatory practices that share life history with Africa and the Black diaspora. The *Change* performances collate Montero's "awareness of the bodily feeling of dance" and Gómez-Barris's kinesthetic "expression[s] of collaboration" to show how movement can be experienced across art forms. Montero's framing of proprioception helps me understand how Ringgold's participatory performances metabolize body image into body process. Because proprioception is an aesthetic sense, Ringgold's *Change* participants and audiences work together, physically and proprioceptively, to pull garbage bags of water.

Documentation from the garbage bag choreography appears in the second quilt in the series, *Change 2* (1988). Images of Ringgold performing

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anchor the corners of the quilt. Centering a self-portrait of an extremely thin Ringgold wearing a bright pink one-piece swimming suit and casting the shadow of a larger body, *Change 2*'s colorful patterned borders project an exuberant, celebratory feeling, different from the contained, somber black-and-white palette of the first quilt. Ringgold's posture recalls her focus on strength training while undertaking the *Change* public diets. In an interview with artist Linda Montano, Ringgold reflects on a childhood characterized by allergies, dietary restrictions, and strict exercise and time management regimens imposed on her by her mother. As an adult, she "nurtured the inactivity" that arose in response to her efficient mother, and eventually "took my burdens with me and was maintaining up into the 250s."[27] When she leveraged her art practice to make a public commitment to lose weight, she used techniques including medically supervised fasting, exercise, and WeightWatchers. She started "eating very much like I did when I was a child, going right back there," and began locating her power, protection, and shielding in muscle strength rather than fat.[28]

In 1988, the same year that Ringgold made *Change 2*, Oprah Winfrey pulled a red wagon piled high with sixty-seven pounds of animal fat onstage during *The Oprah Winfrey Show*. At the time, Winfrey described her diet as a "medically supervised fast," probably similar to Ringgold's experience with Optifast. Years later, Winfrey admitted that "I had literally starved for four months."[29] Although she felt proud of her weight loss, Winfrey describes how she finds the episode "hard to watch" because "I've had to pay the price for that moment over and over. I literally handed to the world on a fat wagon platter the story of 'Is She Fat?' 'Is She Thin?'"[30] These questions become the only ones asked. Ringgold's participatory exertion and choreography around the heavy garbage bags complicate Winfrey's lamentation. Ringgold strains to drag garbage bags filled with bottles of water around the stage. The weight of the water pushes her body to restage the process she undertook to lose these pounds of matter. Her exertion choreographs her struggle.[31] Her body mass has been broken apart, reduced, and transformed. The weight of the water bottles has been released, left behind, and discarded, like the garbage usually placed in garbage bags. At the same time, Ringgold carries that weight with strength and power. Her visible struggle accelerates the sensation of

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**Figure 1.2**
Television talk show host Oprah Winfrey shows off her new figure as she stands in front of a toy wagon full of sixty-seven pounds of fat in Chicago on Tuesday, November 16, 1988. Winfrey credited her sixty-seven-pound weight loss to a liquid diet and exercise. Her goal was to fit into a size ten pair of blue jeans for the first time on her syndicated TV show. AP Photo / Charles Bennet.

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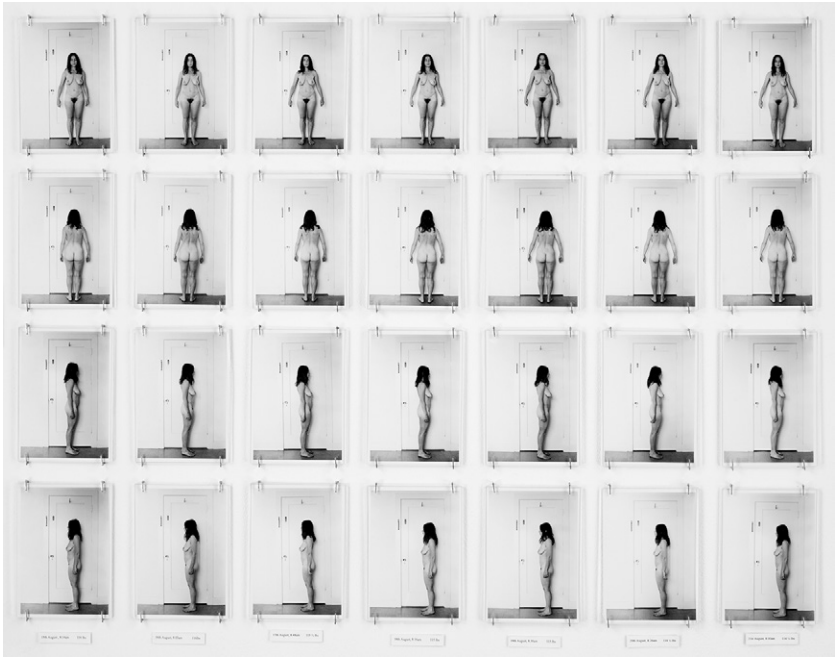

FIGURE 1.3
Eleanor Antin, *Carving: A Traditional Sculpture*, 1972. Detail, twenty-eight of 148 black-and-white photographs with text, four images per day, 7 × 5 in. each. From the collection of the Art Institute of Chicago © Eleanor Antin, courtesy of the artist and Ronald Feldman Gallery, New York City.

weight loss, offering participants a chance to sympathetically proprioceive the changed capacities and sensations of a smaller body.

A decade before Ringgold committed to *Change*, Antin created *Carving: A Traditional Sculpture*, a grid of black-and-white photographs arranging her body in long rows. Each column shows a sequence of daily documentation, from top to bottom, front, back, right profile, and left profile views. Thirty-seven columns represent thirty-eight days of dieting and ten pounds lost (Antin missed one day of documentation traveling). Antin's subtle shrinking cannot be grasped in a single glance; visitors must walk up and down long rows of photographs. When I arrive at the final image after having paced the length of the exhibition space, the first image has faded from detailed memory. Antin stands on a wood floor in front of a white wall, her body framed by a white door. Of this format, scholar

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Joanna Frueh writes, "Far from being glamorous, the four repeated poses turn the poetry of the nude into mug shot prose."[32] The images are blunt, spare, and minimal.

The wall text accompanying *Carving* clarifies that the final photograph depicts "the most perfect nude that was possible for the material with which I was working."[33] Citing Michelangelo on marble, Antin clarifies that the material was her body, and as with marble, "not even the greatest sculptor can make anything that isn't already inside the marble."[34] *Carving* works as "a parody and inversion of the tradition of Greek sculptures in which thin layers were carved from all sides of a form," writes scholar Clare Johnson, marking the critical difference that "the 'material' is her own body and rather than carving the exterior she depletes her body from the inside out."[35] "Most perfect" means "thinner," with Antin's lost weight positioned beside the dust and rubble left over when carving from stone. Evoking Ringgold's discarded garbage bags, depletion from the inside describes an extended catabolic state.

Metabolic readings of *Carving* and Ringgold's *Change* contribute to contemporary art theory's reckoning with feminist body art. Although I would not place *Carving* in Ringgold's "unfathomable" category, Antin's project resonates as a canonical and iconic example of 1970s' performance and body art. Feminist body art has been understood to be a site of controversial confounding of subject/object relations, critique of sociocultural gender roles, and set of artistic methods for rethinking the entanglement of body, culture, and sexuality. Theoretical engagement with feminist body art tends toward specificity, emphasizing unpredictable and potentially therapeutic or psychodynamic encounters between visitors and particular bodies. These practices predict the embrace of scholar Kimberlé Crenshaw's intersectional analytic frameworks that have traveled to the arts from legal theory.[36]

In her survey of feminist body art, scholar Amelia Jones writes that "body art practices solicit rather than distance the spectator, drawing her or him into the work of art as an intersubjective exchange." The cultural effects of the encounter staged between visitor and public body create "disruption," "implication," and "particularized" bodies that "engage specific subjects in a negotiatory and highly charged project of reading and seeing." Body art positions artist and visitor, forcing confrontation.

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These intersections gain power and hermeneutic force from the staging of performance practice alongside traces and documentation. Jones identifies a tension between representational and ontological interpretations of body art when she "rejects . . . metaphysical conceptions of body art or performance as delivering in an unmediated fashion the body of the artist to the viewer."[37] Jones activates complex layers between theory, practice, and history in her analysis, conveying both the controversy and radical alterity of feminist body art, and how such practices circulate and reverberate beyond art settings. Jones rigorously follows postmodern and deconstructivist impulses, so her image-bound psychoanalytic frameworks are always already unstable and in question.

Metabolic reading practices contribute to and trouble the energy systems of psychoanalysis, including concepts of cathexis, drives, and transference. When multispecies bodies, environments, and deconstruction meet, scholar Lynn Turner concludes that "the pathways are always open."[38] Thinking "pathways" and metabolism with Jones, Ringgold, and Antin invites art to evoke psychoanalytic drives while also connecting the sociocultural, the collective, and the specific subject. Feminist histories and theories do not simply map onto or apply to feminist body art. Feminist body art changes and reconfigures feminist histories and theories. By emphasizing body process over body image, a metabolic reading practice allows the bodies of feminist body art to cycle back from their specificity into broader cultural life without becoming fixed to historically and culturally specific psychoanalytic frameworks for subjectivity.

## *Carving* Again

Antin does not reveal if her weight loss in 1972 was undertaken out of the same urgent desire for change that motivated Ringgold. Compared to Ringgold's hundred-plus pounds, ten pounds is not a large amount of weight. It is, however, a popular amount of weight—an amount many people say they would like to lose. The first *Carving* must be understood as both the metabolizing of lived experience and a challenge to figurative sculpture, conceptual art, and the Whitney sculpture biennial curators.[39] Antin's return to *Carving* in 2019 changes the pathways through which

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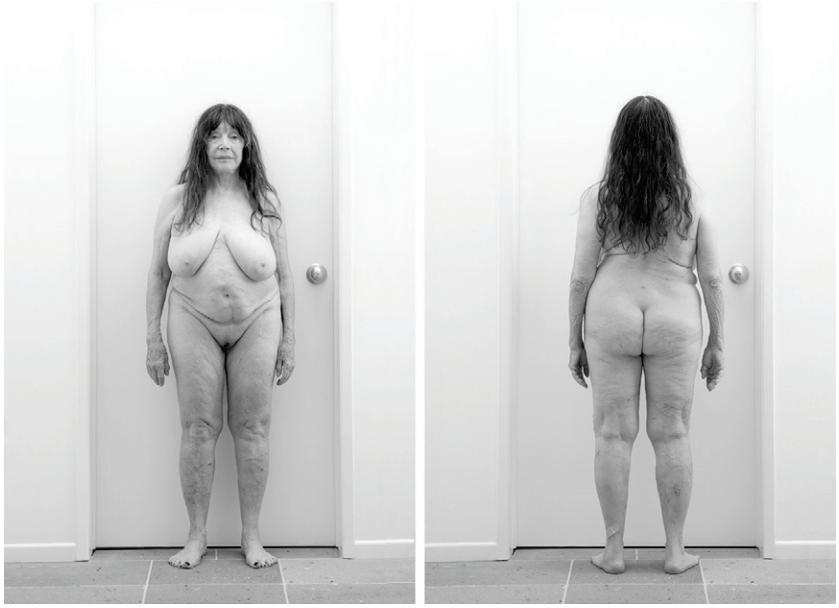

**Figure 1.4**
Eleanor Antin, *Carving: 45 Years Later*, 2017. Detail, two of five hundred black-and-white photographs with text, five images per day, 6.75 × 4.75 in. each. © Eleanor Antin, courtesy of the artist and Ronald Feldman Gallery, New York City.

the project circulates. In 2019, she links weight loss to grief, transforming body image into emotional and psychological body process.

*Carving: 45 Years Later* documents a hundred days of dieting and presents five hundred images in the same format as the 1972 *Carving*, adding a fifth image wearing a bra to afford a better view of Antin's torso. This decision to make the torso visible by lifting the breasts links weight loss and dieting to the abdomen, often a focus in "before/after" weight loss narratives. Antin revisited *Carving* soon after the death of her husband, poet and philosopher David Antin. She explains,

> I was with David for 56 years. It was an incredible romantic and intellectual relationship. We both loved each other's work. When he began getting weaker as a result of the Parkinson's, he needed round-the-clock care, and I knew that when he died it was going to be horrible. I didn't know who Elly would be without this partner who'd been my companion for so long, my whole adulthood really. I knew

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> if I didn't have a big work to do, I would collapse. I'd gained a lot of weight when David was sick, so I said to myself: "You'll do CARVING again, 45 years later."[40]

In the 1972 *Carving*, I learn little about Antin's life from her wall text or images. I see her subtly shrinking body, not large to begin with, and I read her philosophical ruminations on sculpture, marble, and the nude. Speaking about the 2019 restaging of *Carving* in *Eleanor Antin, Time's Arrow*, Antin's voice shifts, becoming personal and urgent as she connects her weight gain to her grief: "'I lost David,' Antin began, 'and now I was losing my body as well.'"[41] Recalling Ringgold's life history with allergies, links between size and strength, and autobiographical body quilts, Antin writes both her biography and metabolism into the work.

In the 1972 *Carving*, Antin develops a catabolic equivalence between her body and a block of marble. The activity of carving both marble and flesh reduces, destroys, and breaks apart. (In contrast to a material such as clay, where creating a figure might involve an additive process of building up and joining.) The wall text for *Carving: 45 Years Later* moves from marble to skeleton as Antin struggles with the last few pounds of desired weight loss: "I believe that my old body was in a valiant and existential struggle to prevent its transformation into the skeleton beneath the protecting flesh . . . death."[42] Antin's skeleton evokes the catabolic state's most extreme form: age-related muscle loss or sarcopenia. Her body's refusal to diminish itself assures her of her vitality and liveliness, even as she grieves David Antin and anticipates her own death.

Although measuring how catabolic states have impacted feminist art and scholarship would be impossible, many, if not most, women have experienced extended catabolic states either because of periods of fasting or dieting, or because of a gendered preference for "catabolic" forms of exercise that reduce rather than bulk up (swimming, aerobics, and running). Catabolic states may appear to be exhausting and depleting even as catabolic processes release energy. The self-portraits Ringgold and Antin attach to their weight loss projects speak to this tension, depicting smaller bodies in powerful poses, recalling Ringgold's realization that she could be both strong and lean.

*Carving: 45 Years Later* culminates in *!!!* (2017), captured at the end of a hundred days of dieting. In *!!!*, Antin pairs a superhero cape with black

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**Figure 1.5**
Eleanor Antin, *!!!*, 2017. Archival pigment print, image size 32 × 22 in., paper size 34 × 24 in. From the exhibition *Eleanor Antin: Time's Arrow* at the Los Angeles County Museum of Art, May 12–July 7, 2019. © Eleanor Antin, courtesy of the artist and Ronald Feldman Gallery, New York City.

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undergarments. She adopts the same pose as Ringgold in her *Change 2* pink swimsuited self-portrait: feet in a strong, wide stance, hands on hips, a smile on her face suggesting success, release, vitality, and satisfaction. These self-portraits inject vivid color into previously monochrome projects. Ringgold's first *Change* quilt was almost entirely black and white, but in her *Change 2* self-portrait, bright patterned borders frame the pink swimming suit. Antin's saturated red cape interrupts the black-and-white *Carving* photos. For Ringgold and Antin, weight loss artworks are more than objects, performances, and exhibitions. With Ringgold accounting for decades of her body's story in her *Change* quilts, and Antin using her *Carving* projects to mark forty-five years of her body in relation to her even longer relationship with her husband, *Change* and *Carving* depict a catabolic feminist consciousness formed alongside the rise of dieting culture, accounting for lives lived in a near-constant state of calorie deficit. The moments chosen for these self-portraits matters. For Ringgold and Antin, and arguably their generation, ideological satisfaction with exercise and dieting coincides with the smallest, not the largest, body size.

The sense of expenditure and release accompanying catabolic states inflects and informs histories of feminist making and thinking. Metabolism seeks balance, but as a dissipative system, metabolism cannot function in homeostasis. An argument could be made that extended catabolic states are limiting, diminishing, or problematic for bodies. Perhaps patriarchy compels catabolic states. But catabolic states cannot be judged in this way any more than bodies can be judged. An impulse to declare bodies of certain sizes or conditions to be participating or not participating in damaging frameworks limits the balancing capacities of metabolic readings. When read as one movement within a system seeking balance, catabolic states need not become limits or lamentations. The more interesting question might be, If feminist body art balanced a tendency toward catabolism, what might this produce, culturally, physically, and emotionally?

The energy released by catabolism fuels anabolism. Both *Carving* and *Change* employ the vocabulary and actions of catabolic reactions—starving, restricting, and breaking down. *Carving* adopts an explicitly catabolic approach, with Antin losing weight based entirely on the logic of calorie deficit. The 1972 wall text notes that Antin intended to include

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exercise in *Carving*, "but this proved unacceptable, in practice, to the artist who appears to have lost her former skills at this technique."[43] Had Antin pursued these lost skills, as Ringgold did during *Change*, *Carving* may have produced very different results. Anabolic states can result in muscle gain, making "anabolic" a catchy vocabulary word for weightlifting and fitness communities. While extreme catabolic states can lead to wasting, anabolic states create more and bigger stuff, producing a tension between different kinds of gains, from the supposedly desirable muscles of a bodybuilder to less desirable metabolic disorders such as diabetes, or more commonly, storing extra energy as fat. But fat does not always indicate trouble: many "obese" people have balanced metabolisms, indicating that their size is appropriate and healthy.[44] Anabolic states of fitness and fatness have continually occupied the arts, giving us everything from the athletic aesthetics inherited from ancient Greece that inspired Antin's *Carving* to size-appreciative adjectives such as "Rubenesque."

## Forging Capacity

At first glance, artist Cassils's six-month durational performance, *Cuts: A Traditional Sculpture* (2011–2013), responds with gusto to a fitness industry that promotes slogans such as "be more anabolic!" and "stay anabolic all day!" Cassils's project produces a defined, muscled body that many would assume to be healthier and stronger than Antin's 1972 body in *Carving*. Like Ringgold and Antin on dieting, Cassils brings critical complexity to their seemingly ideal results. *Cuts* engaged Antin's first *Carving* in the context of a series of commissions pairing contemporary practitioners with the performance archives of Los Angeles to reactivate past performances for new audiences.[45] While Antin's diet induced a catabolic state, Cassils pushes their body into an extended anabolic state, gaining twenty-three pounds of muscle in twenty-three weeks, and documenting the process with the same black-and-white front, back, and profile views Antin presented in *Carving: A Traditional Sculpture*.[46] Cassils gains over twice as much weight as Antin lost, changing their body shape in dramatically visible ways.

Cassils emphasizes this visible change in their presentation of daily black-and-white photographs. Antin's installation does not permit a

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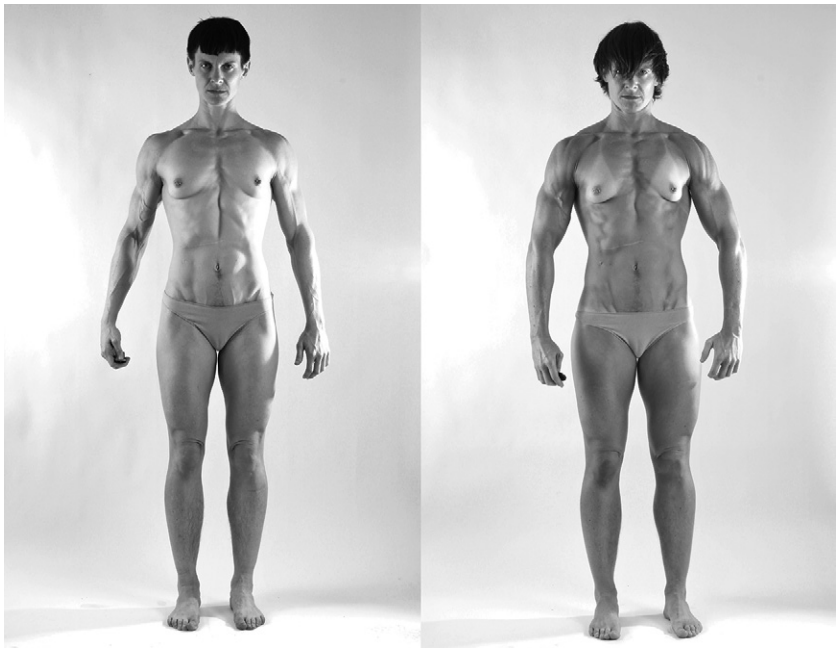

FIGURE 1.6
Cassils, *Cuts: A Traditional Sculpture*, 2011. Detail, time-lapse before and after. Courtesy of the artist.

summary view; standing far enough back from Antin's images to see them all at once renders the photographs too small to read in detail. Cassils instead arranges each view—back, front, left profile, and right profile—into a grid to be read like text from top left to bottom right. A series of animated GIFs circulating on social media further collapses the documentation into easily consumed units that satisfy the desire for before/after transformations.

In addition to the grids, a three-channel video titled *Fast Twitch / Slow Twitch* (2011) focuses on Cassils's training and nutrition, conveyed in both documentary and formal studio footage. Cassils explains that the video "shows every single bit of food that I consumed to create the meat of my body" as well as the workouts undertaken and the project's regimen of supplements.[47] They eat a roast chicken with their bare hands, lift weights, attempt to catch an overwhelming cascade of pills in their open mouth, and split the fabric of a dress shirt by flexing their back muscles.

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**Figure 1.7**
Cassils, *Fast Twitch / Slow Twitch*, 2011. Video stills no. 7 (*top*) and no. 9 (*bottom*). Director of photography: Alison Kelly. Editing: Rhys Ernst. Art department: Brody Creigton. Lighting: Dean Haysaka. Courtesy of the artist.

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The video jumps back and forth in time, resisting the before/after narrative of the photo grids. *Advertisement: Homage to Benglis*, the series of pinup portraits shot at the end of the twenty-three weeks of training, sits alongside *Fast Twitch / Slow Twitch*. In 1974, sculptor Lynda Benglis purchased advertising space in *Artforum* to run a two-page "centerfold" advertisement, half of which was an image of Benglis wearing sunglasses, a large flesh-colored double-headed dildo, and well-oiled tan lines. Cassils and photographer Robin Black skipped *Artforum* and distributed *Advertisement: Homage to Benglis* in gay fashion and art publications. The video and photograph are shown together to complicate the static or finished results seen in *Advertisement*. Cassils stresses that "there is a process of consumption under this capitalist mode that needs to be considered" when confronting the "fixed feeling" of "after" pictures.[48]

Even though Cassils states that "no, I don't identify as a woman," they undertook *Cuts: A Traditional Sculpture* "to explore the social expectations of what a 'woman's' body could be pushed to."[49] Antin and Ringgold critically engage, but in the end conform to these "social expectations": lose weight, discipline the body, and become what Antin's *Carving* wall text describes as "the ideal image toward which the artist aspires."[50] Cassils's artist statement shifts critical engagement into a metabolic register: "Cassils forges a series of powerfully trained bodies for different performative purposes."[51] A metabolic reading complicates the material metaphors guiding these different practices: if Antin's body is marble, "forges" suggests that Cassils's body is metal. If marble is reduced, chipped away, and catabolized, metal connotes additive processes of shaping, casting, sharpening, and joining that allude to anabolism.

Ringgold and Antin critique dieting practices that could eventually become pathological, as with sarcopenia and anorexia nervosa. Cassils and other bodybuilder performance artists, including Francesca Steele, manipulate their bodies to investigate practices that could become pathological as "muscle dysmorphia."[52] After developing her bodybuilding practice at a competitive level, Steele found that "on a yearly basis I revealed an increasingly precariously balanced version of myself," with "balance" referring to health, gender presentation, and emotional well-being.[53] Describing the physical toll of their training for *Cuts*, Cassils articulates a similarly precarious balance:

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> I also felt like shit. I was so tired all the time from all the heavy lifting. My joints ached constantly, and my muscles became so tight that my girlfriend had to take my t-shirt off at night because I was no longer flexible enough to do so myself . . . [I]njury was imminent, and though I managed to stop before it got too bad, it was just a matter of time before I was limping around with buckled knees like all the other body builders.[54]

Steele could be responding directly to this reflection on *Cuts* when she writes, "Where you look your very strongest, most robust and perfectly polished, you are actually at your weakest physically and mentally, more prone to illness or fatality from sport than at any other point during the competition cycle."[55]

Steele, Cassils, and *Cuts* illuminate, as scholar E. Hella Tsaconas puts it, "maximum capacity: precisely where the body's force is overwhelmed by the threat, and the fact, of its impending debility." Tsaconas reads Karl Marx's formulations of labor power to connect bodybuilding, maximum capacity, and the failures of capitalism. After pages and pages of equations and formulas, Marx interrupts himself: "The devil take this wrong arithmetic. But never mind. *Commençons de nouveau*." Marx knows his calculations do not quite add up, but he "perseveres in his mathematics even though this effort will inevitably come apart, much as the successful workings of capital will always eventually lead to its own damage."[56] If extended anabolic states produce more muscle, even excessive muscle, when pushed to "maximum capacity" they also produce the shaky weakness described by Cassils and Steele.

Failure haunts the gym. For Kathy Acker, experimental writer and "serious" bodybuilder, "fail" and "do" are the "only verbs" in the gym, where "meaning approaches breath" in "the language of the body." Acker continues, "I always want to work my muscle . . . until it can no longer move. I want to fail" because failure "breaks muscle so that it can grow back larger."[57] I follow the pathways of bodybuilding to understand how capitalism's anabolic building and constant failure states ensure relentless gain, becoming bigger, stronger, and more fragile with each repetition. Neither bodybuilding nor labor under capitalism allows for the balance that metabolic pathways seek. Together with Ringgold and Antin's reflections on their diets, Cassils's description of how training for *Cuts* made

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them feel, both physically and emotionally, suggests that balance remains elusive. In feminist, queer body art worlds, is homeostasis uninteresting, depoliticized, or disengaged?

## Big Bothering

Perhaps achieving homeostasis and balance requires a step outside norms and expectations. Herrick's *Museum for Obeast Conservation Studies* (*MOCS*) takes up space through techniques of "Big Bothering," an activist crossing of categories that plays with the surveillance vocabulary of "Big Brothering" to overthrow dieting in favor of the "revolutionary maximalism" of bigger bodies.[58] Cassils practices Big Bothering as well, cultivating an anabolic excess not expected of a "woman's" body. Body processes cross political intersections too, as with artist Laura Aguilar's *Three Eagles Flying* (1999), a self-portrait depicting her body noosed, "bound," and "girded" by US and Mexican flags. Deborah Bright continues, finding that "Aguilar's body is monumental in its fecund womanliness, but is trapped and immobilized by conflicting national identities and allegiances."[59] Working with adjacent disciplinary bindings, Herrick's museum "satirizes the stigma and anxiety around obesity, using the tropes of natural history and nature conservation" to create detailed displays, dioramas, and even hunting trophies dedicated to the North American Obeast.[60] A metabolic reading of Herrick's practice critiques the visual cultures of natural history museums to create speculative redirections of community metabolism, or the function of energy flows across ecological zones (see part II, chapter 6).

Herrick's critiques center on an invented wild animal, the obeast, and the obeast is Herrick herself. Obeasts occupy socioecological niches that separate them from hunters, collectors, and research scientists. Dressed in patterned muumuu "pelts," makeup and pelt changes manifest two sexes and three "species" of obeast. Obeasts reject the diet culture underpinning Winfrey's red wagons of fat and Ringgold's garbage bags full of water bottles. These props are irrelevant to them. Obeasts reject humanist ideals and patriarchal society. Obeasts do not need to change, discipline, denigrate, or shame their fat, and this refusal exiles them from domestic space. Obeasts live in the wilderness. Obeasts live "elsewhere."[61]

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FIGURE 1.8
Rachel Herrick, *Museum for Obeast Conservation Studies* (*MOCS*), 2014. Photo credit: Rachel Herrick. Courtesy of the artist.

*MOCS* began while Herrick was sewing muumuus (displayed as "Obeast Pelts" in the museum). The muumuus were designed to interrogate her position as "a fat person at odds with the media's portrayal of fat."[62] They quickly evolved into a larger project when she wondered how nature documentaries and fat bodies might intersect in the form of a film, *Fatties in the Mist*. Although *Fatties in the Mist* was not realized, a series of self-portraits wearing muumuus in natural settings set *MOCS* in motion.

The three "species" of obeast are the North American Obeast, Southern Obeast, and Western Obeast. The species differ in their muumuu pelt patterns and facial adornments, which include eyeglasses and makeup. Referencing taxidermy conventions, an obeast trophy head hangs from the wall while a life-size obeast wearing a green patterned muumuu stands in a diorama surrounded by prairie grasses. Obeast artifacts include pre-Columbian obeast pottery vessels and carvings, obeast "musk" oils and fragrance, and a range of works on paper, including paper dolls, posters, historical photographs and documents, anatomy diagrams, and books. Cataloging the museum's displayed collection becomes overwhelming, implying a vast archive of additional resources.

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In her survey of recent fat positive contemporary art practices, scholar Stefanie Snider argues that Herrick "produces an abundance of fatness and fat fanciful creatures, which despite their purported state of endangerment, seem to overload the visual field with obeasts."[63] This visual overload forces visitors to reckon with simultaneously monolithic and individualized ideas about fatness. The visitor joins the obeast in the wilderness, the elsewhere, just around the corner from their tidy, nuclear, and patriarchal homes.

Although the obeasts are a distributed self-portrait of Herrick, there are no before and after images in this work, no body transformations or big reveals, as in Ringgold, Antin, and Cassils's self-portraiture. Obeasts dwell outside weight loss, fitness, or dieting. *MOCS* conveys a subversive message of acceptance, "wild" pleasure, and delight in Snider's "fat fanciful creatures." Collective scholarly formation Carl Dyke explains, "Rachel isn't much interested in the 'is fat good or bad' conversation, so she moves to the Nature discourse where that conversation makes no sense."[64] Collapsing obeasts and fat bodies into the same category as wild animals lays bare the absurdity of imposing fat phobic paradigms on *all* bodies, whether they be people or animals.

The appetites of obeasts ground the project in not only the activities of eating but in the energies and pathways of metabolic becoming too. The obeast's diet threatens. Obeasts are irresistibly drawn to dumpsters and processed food. In a *MOCS* video series, retail workers arm themselves with a broom to confront an obeast trapped near their store's dumpster, two "obeastologists" sedate and collar an obeast in a meadow, and in an effort to capture a backyard visit on camera, a woman baits an obeast with sliced white bread, a processed food often associated with obesity.[65] The obeast exists at the threshold between social and ecological metabolisms, foraging and consuming in a transformative way; white bread both acclimates the obeast to domestic spaces and signals their untamed roaming hunger.[66]

Domestic space and wilderness are digested in the dumpster, intestines, and natural history and conservation practices of the museum. With dioramas, taxidermy, artifacts in glass vitrines, educational text panels, and even a wall chart tracing an evolutionary path from manatee to obeast, *MOCS* subverts the ideal forms, moral positions, and origin stories expected from what Donna Haraway calls "Teddy Bear Patriarchy."[67]

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Instead of a typical natural history museum visit, which might include dioramas populated by taxidermy, visitors find themselves in the unassuming presence of a muumuu-clad fat white woman with brown hair and glasses. Herrick manipulates conventions familiar to natural history museum visitors to address not "obesity" itself but rather the "obesity panic," the "all-the-sameness" of fat people, and "fat as our culture represents it: simpleminded, undisciplined, and endangered yet threatening."[68] Herrick's obeasts plumb the mysteries of fat, trapping readers in a disturbing yet often hilarious collapse between fat bodies and framings of wilderness that recall the manifest destiny era of colonization, genocide, and conquest in the United States. Even though the turn of the century photographs representing obeasts in the wild show calm groupings ("Mated Pair," "Sub-Adult Male Group," and "Western Obeast Herd"), the obeasts must signal threat, or they would not be mounted as trophies or portrayed looming out of the forested dark as in the "Man-Eating Obeast" poster. The prolific excess of obeast materials, figures, and approaches resists the paradigm of ideal specimens that animates the Teddy Bear Patriarchy by drawing out the terrors and revolutionary pleasures of anabolic gaining, building, and expanding.

Digestion and metabolism are understood differently for domestic versus wild creatures: "obese" or "chonky" domestic pets are routinely folded into diet culture before/after narratives. Alaska's Katmai National Park hosts a "Fat Bear Week" bracket tournament to "celebrate the success of the bears at Brooks River," upending the before/after body-shaming diet photo paradigm to commend bears on weight gained.[69] Bears are "metabolic magicians," able to manipulate their anabolic and catabolic pathways to emerge from months of hibernation without the complications a person might experience after extended immobility.[70] Katmai National Park becomes an elsewhere populated by metabolic magicians without mirrors. Fat Bear Week and *MOCS* expose how diet discourse and pathologizing, judgmental approaches to fat draw absurd lines between domestic space and wilderness, a move that manifests "naturecultures."[71]

## The Language of the Body

The energy balance equation persists in the minds and bodies of gym goers and dieters (anabolism, energy used, subtracted from catabolism,

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energy produced, may somehow correlate to weight gain or loss). But the energy balance equation's "bad math" falls apart, echoing Marx's formulas for labor power.[72] Researchers struggle to define variables, quantifying the self generates unruly data that excludes sociocultural situations, and metabolisms and appetites are reduced to measurable, mechanical components.[73] The energy balance equation scaffolds Hannah Landecker's "industrial bodies," shaped by metabolism's conceptual formation alongside the rise of factory manufacturing.[74] Postindustrial bodies demand new metaphors and figures, but postindustrial bodies do not leave industrial bodies behind to *commençons de nouveau*, begin again. Postindustrial bodies metabolize, change, and process their industrial predecessors.[75] If metabolism can no longer be figured as a lever whose inputs are influenced by exercise or diet, sped up or slowed down, postindustrial metabolisms must be understood as responsive interfaces.[76] Metabolism-as-interface aligns with Pontzer's findings that diet is "just half of the metabolic equation" because metabolisms operate within significant constraints: "our metabolism doesn't *dictate* energy balance it *responds* to energy balance."[77] A responsive imperative changes the stories and images that shape how bodies and worlds interact.

Metabolisms do not create or control environments; they are shaped by the social, gendered, and politically and historically specific atmospheres surrounding them. Images of feminist body art from the 1970s and 1980s are strong, vivid, and clear: Ringgold drags her lost weight around the stage in garbage bags, Antin shrinks into the grid, Carolee Schneemann pulls *Interior Scroll* (1975) from her body, and Hannah Wilke's astonishingly symmetrical breasts reshape the New York art world. Understanding these projects as intergenerational communications marks time, bodies, and shifting identity positions. Metabolic readings do something else again. Metabolic readings confront "shared life history," biologist Lynn Margulis's words for symbiotic collectivities.[78] Image becomes process, and body art becomes life work. Ringgold and Antin emerge from public diets years and decades later, triumphant, power posing. Later in her career, Schneemann's vaginal testimony makes space for a multispecies ecology that crosses barriers between life and death under the gaze of her cat, Kitch. Feline companionship politicizes and witnesses the death processes of friends and strangers. Wilke's body and

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breasts cycle back through *Intra-Venus* (1992–1993), hairless, penetrated by needles, ports, cotton rolls stuffed up her nose, and cancer in her flesh. A metabolic reading of *Intra-Venus* would dwell in the shared life history bound to body process of earlier works. Schneemann and Wilke are two of Jones's key case studies in her book. She writes, "One is precluded from approaching this work without accounting on some level for the complexity, ambiguity, and deeply theoretical (if embodied) nature of Wilke's relationship to her own beauty."[79] Cancer metabolisms become an interface for Wilke's shared life history with her beauty, breasts, mother's breasts, and epigenetic and genetic inheritances. Questions of shaping and controlling body boundaries (boundaries that are also landscapes) and the sociocultural (which is also ecological) become pathways, signals, and fluid movements.

As Ringgold suggests with her title, the word and concept *change* propels responsive metabolic reading practices, signaling transformation, substitution, variation, and permutations. Metabolic processes change a vast array of organic materials, and perceptible shifts in ecosystems, energy levels, and body composition offer sensory access to and perception of these tiny labors. But stuff change too often means fat change. Catabolic losing and anabolic gaining target and discipline fat, seeking to banish or transform it, with anabolic states pitting muscle against fat and falling into the "fat good/fat bad" agenda Herrick's obeast resists. Industrial bodies regard fat as indolent accumulation. Fat became a societal failure, evoking the eugenic logics that propel Haraway's Teddy Bear Patriarchy. Postindustrial bodies understand fat's dynamic contribution to the metabolic interface. Artist and anatomist Nina Sellars makes postindustrial "fluid interventions in anatomy" to show how fat becomes a "vital organ of homeostasis" that "maintains a dynamic equilibrium."[80] Landecker's "fat knowledge" challenges anatomy's dependence on differentiation and cutting.[81] Landecker's fat knowledge and Sellars's "fluid anatomy" mark the transition from industrial to postindustrial metabolism.

Feminist theory has sharpened its edges by denying hunger and turning away from eating and the hungry belly.[82] This sounds a lot like dieting. Food and eating are minimized and actively worked against to shape lean criticality. The hungry obeast must stay away from the landscaped backyard, away from the retail shops. The obeast must forage in the liminal

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spaces between domestic space and colonized property. Have feminisms suffered from a restrictive diet? For scholar Elizabeth Wilson, "If feminist theory is to continue to make trouble, it will need to form intimate and unruly alliances with biological data."[83] Wilson works with data sets from antidepressant research. With nutritionists and sociologists describing women's dieting as an "epidemic," data sets from dieting studies or feminist art theory could present another unruly alliance worth making.[84] Ringgold's *Change* and Antin's *Carving* contour what might be called catabolic feminisms, while Cassils's *Cuts* and Herrick's obeast emerge from a different politics informed by bodies that are simultaneously risking failure, risking "health," and finding power through transgression.

Catabolic and anabolic pathways have entered culture, and are shaped and critiqued by cultural means. Metabolic readings change more than flesh. Strength collides with fragility, fat revolts, in all the fullness of the word, and feminist politics reckon with women spending decades on diets.[85]

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# 2

# Food Babies

In 1987, a young woman in Lesotho, South Africa, went to the hospital because she was going into labor. Labor was a surprise because she did not have a vagina, having been born with Müllerian agenesis or Mayer-Rokitansky-Küster-Hauser syndrome. Women with this genetic difference, or perhaps adaptation, have what doctors describe as a "shallow skin dimple" where a vagina might have been. A healthy baby boy was delivered by C-section. The fifteen-year-old patient had been admitted to the hospital nine months prior with a knife wound to her stomach: "Just before she was stabbed in the abdomen she had practiced fellatio with her new boyfriend and was caught in the act by her former lover. The fight with knives ensued."[1] The knife wound created a passage between her stomach and her reproductive organs. Doctors hypothesize that intrepid sperm survived typically damaging stomach acid, explored their environment, and eventually fertilized an egg. An early fertility treatment in the 1980s called direct intraperitoneal insemination involved injecting sperm into the lower abdomen and hoping for the outcome experienced by this woman.[2]

Usually, "food baby" refers to a bloated belly after a big meal that superficially resembles a pregnancy. But a food baby might be very real, as with the pregnancy described above, where a woman falls pregnant by way of her esophagus. Or a food baby might be fictional. Precursors to scholar Claudia Castañeda's "flexible child-bodies," food babies are figurations or "entit(ies) in the making" composed of all the microbial and multispecies components that make people more than human.[3] Real and speculative stories of falling pregnant by mouth allow access to new scientific understandings of still-emerging entanglements between metabolism

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and reproduction. By making speculative links between digestion and gestation, such pregnancies connect food production and scarcity with the reproduction of growing numbers of hungry people.

Food babies take radically different forms. Having traced a pathway from body image to body process in chapter 1, this chapter cycles body images around a body process. I read the above medical case study beside social media beside speculative fiction beside feminist theory beside bio-art and performance and installation art.[4] Each of these forms of experimentation are bound to material processes that guide metabolic reading practices. Yet the forms of experimentation that animate this chapter are just that: experiments. Material flow and engagement might be pressingly and painfully felt by bodies, speculative and poetic, or entirely absent. Food babies center body process to understand how multispecies metabolisms take shape as sites of entanglement, confusion, and interdependence.

This chapter reads food babies from popular culture alongside novelist Larissa Lai's *Salt Fish Girl* (2002), in which the ancient Chinese goddess Nu Wa causes pregnancies by inhabiting fertile waters and fruits, and designer Ai Hasegawa's speculative obstetric systems *I Wanna Deliver a Shark* (2012) and *I Wanna Deliver a Dolphin* (2013), which model human gestation of nonhuman endangered edible species to address both overfishing and ticking biological clocks. I turn to my own tissue phantom model *Durian Wombs* (2018–2019), inspired by *Salt Fish Girl*, to consider how edible materials circulate in the culture of DIY gynecologic tissue phantoms.[5] The indeterminate bloat caused by food babies signals an unsettling slippage between the digestive and reproductive capacities of bodies. Never born, food babies propose new vocabularies, embodiments, and imaginaries that help me understand links between reproduction and metabolism.

Food baby photographs are a complex genre of self-portraiture that function as internet memes, pranks, and reproductive rehearsals. Burritos, hamburgers, and pizza are familiar sources of food baby bloating, but any food can produce a food baby. Food babies are often photographed in a "before and after" diptych format familiar from the diet reveal photos discussed in chapter 1. The eater's usual body shape stands beside their bloated self. Sometimes food babies insert themselves into the family;

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for instance, a pair of honeymooners sent a food baby photo to their parents as a prank, pretending they had conceived a child instead of a buffet lunch. Food babies reveal pregnancies; actor Lily Anne Harrison, for example, captioned a pregnant selfie "not a burrito belly."[6]

Food babies access overlaps between reproduction and metabolism, which are no longer regarded as discrete processes separated by disciplinary divides. Historically, metabolism has been thought to operate within a "logic of complete conversion," where food enters the mechanical engines of our bodies as caloric fuel. Metabolism and reproduction were assumed to be separate processes because if food is fuel and bodies are motors, metabolism would never extend beyond the life of an organism. Across the sciences and humanities, food scholarship has moved beyond the fuel metaphor, with food understood to be an active agent central to cultural identities, a connective and "withy" system of both "kinship relations" and "agri/cultural relations" enfolded in "industrial dietary regimes."[7] Scholar Hannah Landecker argues that in the biosciences, the distinction between metabolism and reproduction is dissolving and "fraying—and this makes them unstable, rapidly changing terms in the present." Landecker gathers recent experimental results to illustrate the collapse between the previously discrete categories "metabolism" and "reproduction." Genetic material from plants helps to regulate blood lipids in mouse liver tissue.[8] Diet and microbiome influence behavior, contributing to everything from the mating preferences of fruit flies to a person's susceptibility to mosquito bites.[9] Human blood contains microRNAs from bacteria, fungi, yeast, common foods, and even insects.[10] Given these results, complete conversion and the separation of metabolism from reproduction are no longer possible.

What we mammals eat shapes what and how we reproduce ourselves (growing, aging, and moving) and generations. Bodies incorporate constantly shifting and active genetic materials from the plants and animals we eat, our microbiomes, and even the insects and bacteria we live with. No longer the inert "stuff out of which bodies are made," food calls the shots in previously unimaginable ways.[11] "Nutritional epigenetics" gathers research interested in how food impacts the epigenome, made up of heritable marks and modifications to the underlying DNA structure. Nutritional epigenetics extends food's agency for generations. Anticipating

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anticancer and fertility diets in chapter 3, body and environment permeate one another: diet regulates as much as it sustains. This chapter promotes the food baby as a transitional figure, a thought experiment that can help us reimagine food and gestation in the new metabolism.

As a witness to Landecker's "aftermath of categories," the food baby contributes to ongoing feminist efforts to trouble essentialist approaches to biological reproduction. Feminist theory and politics struggle to negotiate tensions between increasing numbers of people on the planet and reproductive justice for women. Sensitive to the cruelty of restricting reproduction and the eugenic implications of such restrictions, many feminists support reproductive freedom but simultaneously acknowledge the urgency of overpopulation. The stories and images that animate this chapter experimentally collapse the motility of tireless sperm flowing and seeking through bodies with the perpetual motion of food systems and digestion. Sperm are too busy, and there are too many people at the table, specifically too many of the privileged extraction-driven inheritors of colonial logics of consumption. The demand for food aggravates the climate crisis, with beef and dairy production contributing to greenhouse gas emissions, while dwindling habitats and warming waters threaten biodiversity. Faced with an increasing number of people sharing deteriorating and endangered environmental resources, scholar Donna Haraway has famously proposed the slogan, "make kin, not babies."[12] With Haraway, scholar Adele Clarke edited the book *Making Kin Not Population*, which softens Haraway's slogan with its title while asking challenging questions that draw together feminist approaches to reproduction, environment, and making kin beyond sexual reproduction.

Clarke asks the critical question, "Are (many? most?) contemporary feminism(s) and feminist science studies *tacitly* pronatalist?"[13] Clarke refers to a flourishing feminist scholarship devoted to fertility discourse and in vitro fertilization (IVF) technology. Structures of domination—white supremacy, colonial extractionism, and anthropocentrism—scaffold the pronatalist frameworks that support population debates. Each contributes to the "booming silence" Haraway observes around nonnatalist feminisms, even among progressive feminists.[14] Looking to nonbiological kinship for alternatives to "making babies" reveals how crossings between digestion and gestation form multispecies bonds.

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The food baby suggests a loose and usually speculative equivalence between meals and babies, where the food baby is typically fictional and fantastic. In contrast, Landecker's very real "human body . . . teeming with genetic components from the plants, microbes, and insects that humans live with and ingest" suggests how collapsing digestion and gestation produces material, embodied effects that might be sensed.[15] Questions of sensation link food baby imaginaries to blurred boundaries in living bodies. Food babies make their presence known through sensations of visceroception, peristaltic contraction, and digestion as well as visual and haptic shifts caused by bloating.

Food babies work against human exceptionalism to promote motherhood in an expanded field. Scholar Astrida Neimanis theorizes "posthuman gestationality" as "the giving over of one's own materiality for this proliferation of further life, different to one's own"—an activity not necessarily connected to birthing babies or "sexuate dualism."[16] Food babies apply words such as "conceive," "carry," "bear," and "expect" to our food. Our meals, after all, do form new life both within bodies and, given nutritional epigenetics, across generations.

Scholar Myra Hird asks, "What might feminist politics look like from the difference that metabolism makes?" Like Landecker, Hird knows that the distinction between metabolism and reproduction no longer holds. For Hird, metabolism "precedes sexual difference," becoming "a metabolic contagion" that serves as "a foil to sexual difference."[17] Metabolism's reproductive capacities make ontological distinctions between people presenting as men and people presenting as women more complicated, if not impossible, just as Neimanis's posthuman gestationality allows for material generosity from any body with material to share. The stakes of this collapse for feminist theory and life on Earth lead Hird to write metabolism as a foundational force that extends beyond bodies to conceptualize weather and environmental conditions on a planetary scale.

As Landecker reminds us, "We are what we eat—but also what our parents and grandparents ate, and what we eat ate, and other expansions of networks of significant ingestions."[18] Food babies feel and see these expanded networks, perhaps even Hird's planetary networks, as gestational relationships: bodily materiality facilitates the lives held by the

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food I eat and the food systems I support. Food persists beyond body boundaries and body waste. The fertility and anticancer diets explored in chapter 3 impact the health of the eater and their capacity to fight cancer or conceive a child, and also influence the metabolic systems of illnesses, ovaries, and the future metabolisms of the eater's children and grandchildren.

Food babies are pronatalist and nonnatalist at once.[19] Some women regard a food baby as a practice run, a way to visualize what they will look like when carrying a fetus instead of a pancake breakfast. These food babies celebrate fertility and look forward to future pregnancies. Other food babies are actual pregnancies, as with the stab wound victim in Lesotho and the fictional durian-assisted reproduction depicted in *Salt Fish Girl*. Still other food babies are nonnatalist for people but pronatalist for the endangered species that women deliver—and potentially consume—in Hasegawa's speculative design practice.

Food babies connect the possibility of future pregnancy with the struggle to reconcile industrial eating and ethical living. Haraway narrates an embodied feeling that shares symptoms with a food baby, describing a "painful mass in my gut" as the "bodily feeling of grief, exploding from the inside out." This pain, "slicing up my entrails," invokes what scholar Deborah Bird Rose names as "double death" or "surplus killing."[20] Rose argues that large-scale environmental devastation exceeds the usual understanding of death and so death must double. Double death accelerates, emerging from this "amplification of death, so that the balance between life and death is overrun, and death starts piling up corpses in the land of the living."[21] For Haraway, double death signals the loss of "whole patterns of living and dying on earth." A pain located in the gut, a pain that pressures and threatens "rupture," binds Haraway to industrial livestock, who suffer what Haraway, after Rose, calls "'double birth,' . . . the perversion of birthing . . . of humans and of other critters," into "extractionist, exterminationist colonialism and capitalism."[22] Haraway's nonnatalist politics collapse metabolism and reproduction by linking food and eating with reproducing generations of entangled others, including industrial livestock. Grieving in the gut incubates webs of connection between people, animals, and food systems, recalling Neimanis's "posthuman gestationality" framework. Although factory farms,

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mass extinction events, and nuclear family homes may seem outside the body, Haraway's rupturing entrails find metabolic pathways linking these sites and eating bodies.

Haraway insists on her stomach tied in knots as an analytic site. Artist and scholar Natalie Loveless describes knots as "sites of productive dissent and dissonance."[23] "Make kin, not babies" functions in this way, knotting together the possibilities of forming bonds, including multispecies bonds, with the controversial command (k)not to pursue human biological reproduction.

## If Food Babies Were Real

"Food baby" could invoke the impulse to bite and chew baby flesh, their arms resembling bread rolls, their prematurity of birth suggesting the texture of something delectably half-baked and chewy. A 2013 study begins to explain comments directed at babies such as "I could eat you up!" with data indicating that baby body odors activate "cerebral reward learning networks," the same networks stimulated by food.[24] With the edibility of babies in mind, I stay focused on the abdomens of adults.[25] A site of sensory engagement with metabolism, food babies connect a seemingly straightforward visual comprehension of bodies to more complex sensory capacities, from viscerception to conscious awareness of typically unconscious and subtle peristaltic contractions. As bodies labor their food, peristaltic contractions become more obvious when the digestive system must accommodate excessive air or gas.

Food baby jokes undoubtedly predate the internet, but the food baby meme has flourished on social media. The vast majority of food baby images depict women monitoring the external changes their bodies' experience as they digest their food.[26] These self-portraits show fluctuating intestinal bloat and are sometimes time stamped, such as 11 p.m. bloat on the left, and early the following day on the right. Although anyone can have a food baby, most before and after pictures feature average-size, skinny, or athletic bodies. Occasionally a picture of an actual pregnancy receives a new caption to suggest a food baby. Sometimes the food baby manifests as an ultrasound image featuring the ghostly imprint of common bloating culprits, such as a hamburger or pizza.

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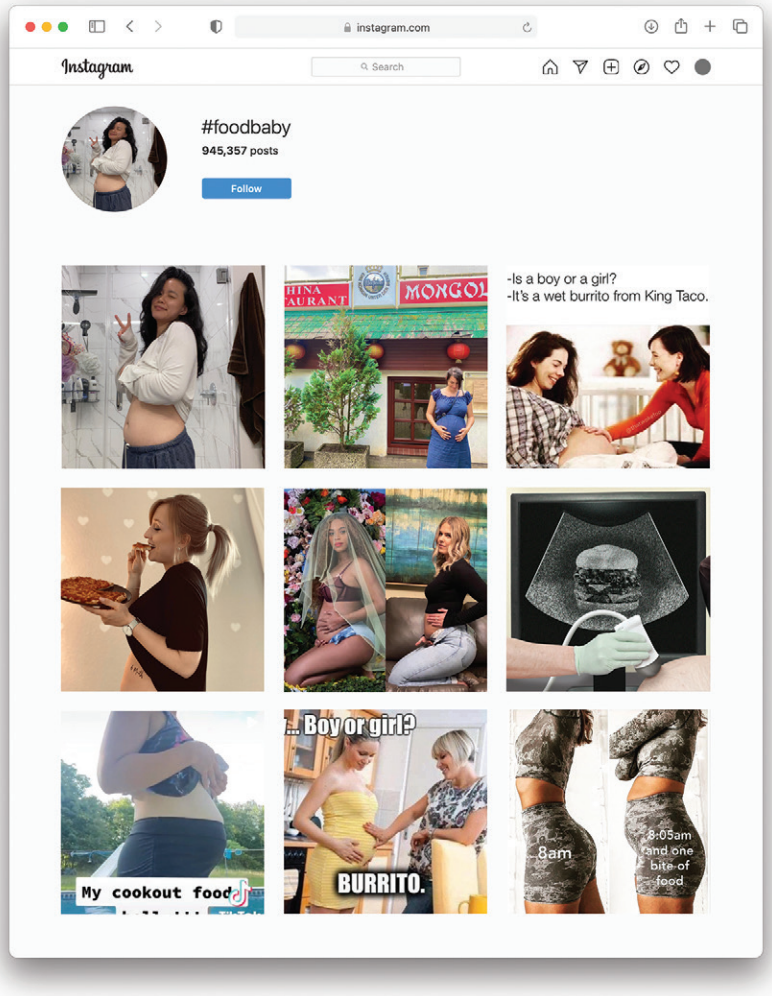


FIGURE 2.1
Screenshot of the #Foodbaby hashtag on Instagram, July 2021.

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These ultrasound images may have inspired YouTuber twins Veronica and Vanessa Merrell, who crafted an elaborate ten-minute video complete with a pregnancy test and hospital visit titled *If Food Babies Were Real* (2018).[27] Vanessa feels sick to her stomach, and Veronica, sitting across the dining table from her, surmises she may be having a food baby. Vanessa eventually goes to the hospital to labor and deliver a large hamburger, which sleeps in an improvised kitchen nursery. For a brief moment after the birth of the hamburger, Vanessa seems poised to take a bite out of the hamburger herself, but instead she cuddles it close, remarking that her food baby smells "amazing." The authors of the infant odor study would not be surprised by Vanessa's maternal appetites. They found that food gave "an equal amount of biological reward as the infant's body odor."[28] She bottle-feeds the hamburger with ketchup and mustard, adding a slice of cheese when the pacifier fails to calm. Before long, a hungry cousin inadvertently eats the diapered hamburger, presumably ending its short life.

This funny and playful food baby story was probably not intended to challenge norms, but the video nonetheless develops a radical vision of kinship and family. The food baby has no father, implying parthenogenesis. Veronica partners with her twin to support her in the delivery room and assist her with the food baby's feeding and her interrupted sleep cycles. Although their father, friends, and hungry cousin play supportive roles, the family unit becomes twin sister coparents and a woman-born hamburger. With links to the environmental devastation of the meat industry, the hamburger could be interpreted as a symbol of Haraway's "double birth," the human-born offspring of industrial food systems. The queer kinship depicted in *If Food Babies Were Real* thoroughly confuses digestion, metabolism, sexual reproduction, and the cultural trappings that have developed to enforce their historical separation. Rituals of birth—telling the parents, the baby shower, hospital, and exhausting care work—collide with sensory experiences of food and eating to reveal how food, even and perhaps especially fast food, can be a site of Neimanis's posthuman gestationality. The twins give their hungry hamburger their bodies, time, and care.

Collapsing metabolism and reproduction troubles the assumption that a separate sphere of genetics guides inheritance from generation

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to generation. The body figured as a flame or caloric engine burning, vaporizing, or destroying food in the fiery inferno of the digestive tract gives way to a more complex view of a body and environment enmeshed. Food baby imagery develops this new understanding of food as an active agent of change as well as decision maker within bodies and across generations. The hamburger baby cries, communicates, and demands care from their mothers. Food babies grant personhood, self-awareness, and consciousness to digested matter, reinforcing scholar Elizabeth Wilson's assertion that "the gut is an organ of mind: it ruminates, deliberates, comprehends."[29] At the same time, the hamburger baby implies that food itself might manifest some of the qualities and capacities of mind, seeking nourishment and comfort. As with the passage opened by the knife fight in Lesotho and the hospital delivery of a hamburger, the improbable and remarkable rise to the surface when metabolism and digestion merge with sexual reproduction.

Lai's novel *Salt Fish Girl* moves between ancient pasts and near futures to narrate a series of linked speculative scenes. Although never named as such in the novel, food babies appear repeatedly. Nu Wa, the shape-shifting snake mother goddess from Old China, crosses paths with Miranda Ching, a girl growing up in a corporate-controlled compound called Serendipity in the Pacific Northwest, circa 2044. Nu Wa moves through watery forms of fertility, embodiment, and edible exchange, forming queer, olfactory attachments across time and species. In the ancient past, Nu Wa creates people from discarded disfigured fish sculptures that reanimate themselves and emerge from primordial river waters. Eventually, one of these women ingests and gestates Nu Wa. Born in a human body, Nu Wa grows up and falls in love with the otherwise unnamed Salt Fish Girl.

The novel queers reproduction by finding fertility in the digestive tract. Nu Wa impregnates exclusively through the mouth and in different ways. She first takes an embodied form after being swallowed in a gulp of river water. Nu Wa swims through the body into conception:

> My eyes opened when a shadow fell across the water. It was the woman's face, big and round as a dinner plate. Her hand appeared above the surface, enormous and wielding a huge drinking cup. Before I could understand what was happening, she dipped the cup into the

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> cistern and scooped up a cup of water, and me along with it. Didn't she know that it was unwise to drink unboiled river water? She lifted the cup to her lips and down I went in the first gulp. I glided down her throat and slid into her womb. Nine months later, I emerged as a bawling black-haired baby girl.[30]

Nu Wa has no trouble moving from throat to womb. As with the knife fight pregnancy in Lesotho, she finds an unexpected passage. River, drinking, and amniotic waters converge. Nu Wa eventually returns to the water, where her aquatic form nourishes the roots of a durian tree in the Unregulated Zone outside Serendipity's walls. Miranda's mother is "a good eight years past menopause" at the time of her conception. This, plus Miranda's persistent odor of durian—"I was a reeking bundle . . . My sour body stank up the whole house"—marks her as a food baby, conceived through ingestion and marked by epigenetic inheritances.[31] Nu Wa's Unregulated Zone durian tree acts as a reproductive aid to Miranda's mother, a class of subhuman clones, the Sonias, and eventually to Miranda herself. Scholar Paul Lai describes the novel as "a fishy genealogy" where "stinky bodies" tease out relationships between smelling, tasting, and gestating.[32] For scholar Aimee Bahng, the durian fruit gives form to the tension between the novel's different futures: "Conceived in a moment when her mother craved wild durian, Miranda embodies her mother's momentary rebellion against the privatization of food." Bahng enfolds the durian into a "politics of mutation," its watery agency linking smell, queer love, gestation, and food to allow Nu Wa, bodies of water, and the durian fruit to impregnate women by moving from throat to womb, first as a small wriggling sperm-like snake critter in the river and then as a watery life force that extends the capacities of the Unregulated Zone durian tree.[33] But always through the mouth.

I developed *Durian Wombs*, a recipe for an edible tissue phantom, to create a digestive network inspired by *Salt Fish Girl*. Tissue phantoms mimic flesh to teach diagnostic skills to medical professionals without recourse to cadavers or living bodies. Small parcels of durian-flavored agar-agar were served as one of several menu items during a series of tasting performances developed alongside my installation *Ballistic Bundts* (2018–2019). The installation hosting the performances contained less ephemeral and nonedible sculptures in the form of Bundt cakes made

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FIGURE 2.2
Lindsay Kelley, *Ballistic Bundts*, 2018. Photo credit: Campbell Henderson. Courtesy of the author.

from ballistic gel, a synthetic material designed to imitate the density and texture of flesh to test projectile and other weapons. The Bundts were shot with various guns and rifles, which left trails, wounds, and embedded bullet fragments in their transparent fleshy bodies. In conversation with Katie Dyer, Lizzie Muller describes each Bundt as an "explosive violent moment visibly frozen in time."[34] A cloudier brown-tinged ballistic gel can be made at home using concentrated beef gelatin. I chose to work with a commercial product sold as Clear Ballistics because of its transparent, jewellike appearance. While creating the *Ballistic Bundts*, my research on ballistic gel introduced me to the use of this flesh-mimicking material in tissue phantom modeling.

I made the edible tissue phantoms to connect the familiar aspects of gelatin to its more specialist uses, placing abstract labor power beside specifically obstetric labor. Before it was a ballistic testing material or tissue phantom, gelatin was both something to eat and a preservation method. But gelatin has always worn disguises. Scholar Nicole Shukin dwells on the material implications of Karl Marx's description of the

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FIGURE 2.3
Lindsay Kelley, *Ballistic Bundts*, 2018. Detail, *Durian Wombs*. Photo credit: Campbell Henderson. Courtesy of the author.

"abstract element common to all commodities as mere jelly of undifferentiated human labor." For Marx, mere jelly was a metaphor, but for Shukin and me, mere jelly is "uncannily evocative of the animal fats and gelatins being literally extruded" during Marx's lifetime, and still being extruded today.[35]

*Durian Wombs* are durian-flavored agar-agar blobs, each containing a suspended grape. The size of a small handful, they are a pale yellow color, similar to the flesh of durian fruit. Serving the *Durian Wombs* involves snipping open the latex balloon that gives them their variable soft shapes and then squeezing to pop each one out onto a plate. A series of interactive tasting performances were staged within the *Ballistic Bundts* installation, which was set up to function as a kitchen, complete with a sink and stove burner. Curators Dyer and Muller explain that interactive elements of the exhibition, including the kitchen, were designed to "move knowledge into a sensory experience."[36]

Tissue phantoms are used extensively in radiology, with practitioners manipulating phantoms to acquire and hone the skills required for

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medical procedures. Ultrasound technicians practice on phantom wombs that are often made in whole or part from ballistic gel or beef gelatin. Tissue phantoms for ultrasound recall the food baby ultrasound spoofs that show a pizza or hamburger in the womb. The edible materials preferred for such phantoms make the pizza and hamburger ultrasound memes more plausible than their creators intended.

Practitioners who make their own phantoms create instructional videos that resemble cooking shows.[37] The recipe for the early pregnancy ultrasound phantom that inspired *Durian Wombs* begins with a grape selected or cut down to simulate the size of fetus desired for the phantom. After inserting the grape into an ordinary rubber balloon, the balloon is filled with water. Suspended inside a concentrated gelatin solution, this assemblage appears to float as if inside a womb. For ease of serving, I stopped at the balloon stage, creating dumpling-like packets comprised of a balloon containing a grape suspended within an agar-agar-based, durian-flavored dessert custard.

*Durian Wombs* enfold several of *Salt Fish Girl*'s complex plotlines into one edible object. The grape/fetus rests in durian custard. The durian becomes a womb and site of fecund potential. When I eat a *Durian Womb*, the durian's reproductive agency in the novel leaves an olfactory trace on my body, not unlike Miranda's persistent durian odor. *Durian Wombs* highlight the use of edible materials in tissue phantom manufacturing, what I refer to in performance as "conceptual cannibalism."[38] Medical professionals turn to edible materials when creating phantoms because food is available and inexpensive, and because flesh's kinship with gelatin, fruit, meat, and vegetables gives better clinical results than expensive synthetic alternatives. Oranges become prostates, grapes become embryos, and straws pulled from gelatin become hollow veins. Clinicians do not usually intend for the phantoms they make to be eaten. Eating a slippery, milky *Durian Womb* violates some of the same boundaries between fertility and biological reproduction that Lai plays with in her novel.

When specific foods and gulps of water cause women to fall pregnant in Lai's speculative pasts and futures, these ingestions influence generations. Durian-assisted reproduction produces ongoing effects that recall Landecker's collection of recent surprising findings in biology. Together, the reality of Landecker's results and speculative fiction of *Salt Fish Girl*'s

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food babies show how ingested matter moves beyond fuel metaphors to "run the operation of being a body."[39] With *Salt Fish Girl*, food acts beyond the lifetimes of specific bodies, creating a narrative and sensory scaffold to support findings that "the quantity and quality of food eaten by a parent (the so-called outside environment) affects the constitution (inside environment) of the body, thereby affecting the potential of genes to be expressed."[40] Miranda's lingering durian odor provides sensory access to her epigenetic inheritance.

## Motherhood in an Expanded Field

Hasegawa's food babies create embodied sensory experiences from the multispecies entanglements that connect eating and reproduction. Her practice develops speculative birth and death scenarios in sites as diverse as love hotels, science labs, social networks, and card games. Based at the University of Tokyo, Hasegawa's context in Japan—where the birth rate continues to fall—inflects her design work. Writing about "New Feminist Biopolitics in Ultra-Low-Fertility Asia," Scholars Yu-Ling Huang and Chia-Ling Wu advocate for "緣-connected societies"; in Chinese, 緣 (*yuan*) translates as "innovative community-oriented social relations beyond the family." Huang and Wu detail examples from caregiver cafés to cross-generational coliving arrangements to robotic pets. Vanessa and Veronica's hamburger baby could be interpreted as an example of 緣, with twin sisters taking on parenting responsibilities for a nonhuman child. If "ultra-low fertility . . . can be a strong stimulant for a more en-connected world," then Hasegawa's propositions manifest 緣 at a planetary scale.[41]

*I Wanna Deliver a Shark* and *I Wanna Deliver a Dolphin* are complex design fictions that take shape through flowcharts, obstetric models, and video documentation. The works imagine near-future opportunities for women to experience childbirth by gestating and birthing another species without growing the human population. Given booming populations and food shortages, Hasegawa asks, "Would a new mother consider incubating and giving birth to an endangered species such as a shark, tuna or dolphin?"[42] Hasegawa's *Dilemma Chart (Why Don't I Get Pregnant with . . .)* accompanies *I Wanna Deliver a Dolphin* to assist potential mothers in "giving birth to our food." Asking questions such as "Do we need

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FIGURE 2.4
Ai Hasegawa, *I Wanna Deliver a Dolphin*, 2013. Courtesy of Ai Hasegawa.

more humans?" and "Do you like to eat and do you care about sustainability?" the flowchart arrives at three outcomes: having a human child, not having a child ("Lucky you! Have a great life!"), or having an "animal child" who could fall into one of three categories: domestic animal (cat or dog), endangered species (leopard or panda), or the focus of the shark and dolphin projects, "an endangered species that humans eat."[43]

*I Wanna Deliver a Shark* starts with the spiny dogfish, *Squalus acanthias*, classified as vulnerable because of overfishing. Hasegawa works with doctors and embryologists to test actual technologies and compatibilities to create an accessible and plausible starting place for the project. In the case of *I Wanna Deliver a Shark*, the gestating shark was found to be compatible in size with a person's uterus, and the skin patch medication administered to shark mothers to allow for interspecies gestation takes inspiration from betamimetics—real medication used to suppress contractions in high-risk pregnancies and prevent premature delivery. Hasegawa's food babies scale up links between reproduction and metabolism to comment on everything from the biological clocks ticking within conflicted women to endangered species, extinction, and overfishing.

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Hird's planetary metabolic force gives maternal bodies sensory access to the global effects of overfishing and warming waters.

After introducing the spiny dogfish and its threatened status, Hasegawa details the technical process for carrying a spiny dogfish pregnancy. After delivery, a GPS sensor allows the new mother to locate the released shark in the open ocean. Recalling the ultrasound images of hamburgers and pizza, an ultrasound image of a spiny dogfish opens Hasegawa's project narrative. Hasegawa provides detailed supporting documentation, medical models, and flowcharts to build the speculative world of *I Wanna Deliver a Shark*. Inspired by research into artificial uteri for shark embryos, the technologies underpinning Hasegawa's cross-species pregnancy system include supplements, filtration, and monitoring sensors. Because shark gestation requires the suppression of menstruation, postmenopausal women (like Miranda's mother in *Salt Fish Girl*) are ideal candidates for spiny dogfish motherhood. After birth, GPS tracking targets the shark's ampullary receptors to allow for a mother and child reunion at sea.

*I Wanna Deliver a Dolphin* iterates expanded motherhood with new technical challenges to solve and further research into interspecies food babies—in this case, the critically endangered Māui dolphin, a subspecies of *Cephalorhynchus hectori*. Hasegawa builds a medical model depicting the "dolph-human placenta" and consults with specialists to negotiate differences between dolphin and human reproductive systems. Dolphins pass their immune systems to their offspring with their first milk instead of through their placenta. In response, Hasegawa designs synthetic first milk that mothers can feed their dolphin offspring—a process familiar from bottle-feeding human infants. The desire for birth and gestation mingles with the hunger for dinner.

Life-giving waters invoke Neimanis's "fishy beginnings" as amniotic and planetary waters converge—including, in this instance, swimming pool waters.[44] The video and still photographs accompanying *I Wanna Deliver a Dolphin* vividly document this speculative birth.[45] A heavily pregnant woman swims into the final stages of labor in turquoise waters, her white gown giving way to a plume of blood as the dolphin calf's flukes emerge from between her legs. The new mother inoculates her offspring with Hasegawa's specially engineered interspecies first milk using

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FIGURE 2.5
Ai Hasegawa, *Untitled*, 2011. Courtesy of Ai Hasegawa.

a white syringe, and the two swim off-screen in tandem. The waters supporting this cross-species birth event stand in for the Māui dolphin's environment in Aotearoa / New Zealand, depleted and overfished waters worldwide, and the gestational waters and milks that link all mammals.

Although the mother featured in *I Wanna Deliver a Dolphin* does not eat her dolphin offspring—at least not on-screen—another short video from Hasegawa depicts a delivery moving quickly and seamlessly into ritual ingestion.[46] A young woman breathing heavily, perspiring, and visibly struggling in labor ejects a silvery salmon onto a metal prep tray. She layers a black robe over the red robe worn for the birth. Her doctor transforms from gynecologist to chef. The new mother brings delicate bites of sashimi to her mouth only moments after releasing the salmon from her body.

Hasegawa's gestations of fish and aquatic mammals return us to the rupturing pain in Haraway's abdomen. These "double births" connect overfishing, climate crisis, and mass extinction by bringing human reproduction into dialogue with food systems in unexpected ways. In Hasegawa's speculative birthing kitchens, food babies link the food supply to the maternal impulse, helping me understand how I am constantly and continually in gestational relation with the food I eat, endangered ocean

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species, and increasing numbers of people on the planet. Recalling the Merrell twins parenting their hamburger baby on social media, the cross-species dolphin and shark deliveries emphasize our food's agency, willfulness, and reproductive capacities.

This chapter draws together an extended, 緣-connected family of seemingly different food babies. The knife fight pregnancy produces the only conventional and nonfictional child among them: conceived through ingestion, this food baby demonstrates the fragility of the membranes that separate digestion from the reproductive system. Slippage between metabolic and reproductive processes may occur at the anatomical, not only cellular, level. Lai's *Salt Fish Girl* contributes two unique food babies, one conceived after drinking river water, and the other after consuming durian fruit from a tree nourished by the same waters. Speculative fiction offers an experimental format capable of imagining how culturally significant foods such as the durian might form digestive networks that evolve and travel through time. Inspired by Lai's novel, the *Durian Wombs* recipe serves slippery dollops of agar-agar that couple the size and shape of gestating wombs with the durian sensory environments that permeate Lai's heroine, Miranda. Making Lai's digestive networks tangible and sensible expands the novel's food baby proposition by infecting each participant with a lingering taste and odor after eating a tissue phantom womb (recalling Felix Gonzalez-Torres's candy spills).

Read together, these food baby experiments take metabolic form. Consider each experiment as a networked pathway, with metabolic reading practices moving and transforming matter between medical case study to social media to speculative fiction to feminist theory to bioart and performance and installation art. Hasegawa's speculative design fictions incubate endangered marine life in human wombs, connecting ticking biological clocks and postmenopausal uteri to depleted and overfished waterways. She works across video installation, design, and scientific publishing processes to convey research that draws on the mixed methodology that characterizes bioart. From her consultative process with research scientists and findings to her figurations, which draw on the visual and performance cultures of scientific praxis, Hasegawa's works become legible as art, design, social activism, speculative fiction, and credible scientific research. These carefully framed sharks and dolphins present an

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alternative to the commercial fishing practices that have brought us to a point where, for scholar Elspeth Probyn, "we are at risk of eating [the ocean] up, devouring it until there is nothing left except the not-so-apocryphal jellyfish-and-chips."[47] Hasegawa imagines how Neimanis's posthuman gestationality might lend human materiality to ocean worlds, potentially intervening in Probyn's devouring scarcity.

Haraway's painful, rupturing guts couple with the sensory experience of digesting food babies to render these fleshy and fictive figures visceral and tangible. Carrying double birth and double death, food babies broadcast gut feelings about the links between our individual eating habits and colonial industrial capitalism. This grouping of speculative and real food babies rethinks the familiar meme to draw out its subversive potential, as with the queer 緣 family formed by the Merrell twins and their hamburger offspring. Hasegawa makes kin and babies without making population, while Lai transforms fertility and reproduction through multispecies assemblages and feminist proletariat clone revolutionaries.

Landecker points to a lack of theoretical models to make sense of experimental outcomes in the biosciences that challenge historic divisions in histories of biology. Researchers frequently use the word "surprising," signaling a struggle to story new findings that question the separation of reproduction and metabolism. Landecker observes that "there is a manifest lack of theory to pin all these disparate findings to," implying that this startling evidence of the agency and decision-making capacities of food within our metabolic processes requires additional narrative force to become legible. The metabolic arts manifest an abundance of theory, putting forward new principles and propositions designed to allow uneasy access to the unexpected connections found in Landecker's collection of results. If our metabolic processes can make decisions and indeed "run the operation of being a body," then creative approaches to communication with our guts and viscera are urgently required to live and embody the collapse between metabolism and reproduction.[48]

When metabolism infects and precedes sexual difference, questions about things bodies do or do not do (menstruation, lactation, and conventional gestation) become less important and sometimes less clear. Everybody eats. Bodies that cannot or choose not to bear children can still carry food babies. Food babies and the new metabolism destabilize

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any last efforts to prop up essentialist readings of sexed bodies. Feminist theories of the body, from Simone de Beauvoir's second sex and Judith Butler's gender performativity to Sophie Lewis's feminism against family, have worked to disentangle sex from gender and queer reproduction.[49] Neimanis's posthuman gestationality emerges as one of few theoretical frameworks from the antiessentialist project that both queers reproduction and might account for our food's capacity to be heritable, gestated, and born. If posthuman gestationality embraces food and eating, then modes of reproduction that depend on biological kinship and essential sexual difference become as historically dated as scientific understandings of metabolism that rely on logics of complete conversion and the combustion of calories.

Narrowing the gap between food babies and flesh-and-blood children in the world allows reproduction, nonbiological kinship, and feminist politics to flow through one another: everybody eats, everybody metabolizes, and occasionally, everybody will carry a food baby. Food baby sensations approach what Hird describes as "a feminist politics based on metabolic contagion rather than sexual difference."[50] By moving away from humanist notions of individuality, this politics of contagion recognizes how metabolic processes complicate sexual difference.

Returning to Haraway's slogan "make kin, not babies," and its less commanding book title manifestation, *Making Kin Not Population*, the twin problems of food and overpopulation might be productively rethought while carrying a food baby. If some women regard food babies as a preview of their future pregnant bodies, why not deepen that regard and consider food babies as kin-making with food and food systems? Recalling the double births and double deaths threatening to rupture Haraway's guts, food babies insist that what I eat does something. A quick food baby communicates: the stirrings and rumblings of the gut are messages from microbiota sending us information about industrial food systems, fragile ecosystems, changing climates, and government policies.

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# 3

# Eggs, Kale, Cancer, Fertility

In this chapter, "food as medicine" describes diets designed to support fertility or inhibit cancer. "Food as medicine" additionally includes the approach of eaters who might be restricting gluten to manage celiac disease or other intolerances, attending to how sweets impact blood sugar, or eating against inflammation for gut health. Medicine taken by mouth acts like food, with "pharmacokinetics" referring to the distribution, digestion, metabolism, and excretion of drugs. Fertility and cancer patients eat hormones and chemotherapy alongside the recommended dark leafy greens. Anticancer diets seek to slow the proliferation of cancer cells, while fertility diets encourage the formation of zygotes that could proliferate into embryos and eventually fetuses. Although wanting seemingly opposing outcomes, fertility and anticancer diets are remarkably similar. How do cancer and babies relate to one another?

The artworks that animate this chapter help me understand and internalize the shift from food as fuel to food as environment articulated by Hannah Landecker and others. Fighting the violence of well-meaning but ableist unsolicited advice, these feminist diets emerge from lived struggles to sustain or inhibit particular cellular lives and the embodiments that unfold from each. Beatriz da Costa's *The Cost of Life* projects are offset by Lu Yang's layered, bright, and frenetic video installation *Cancer Baby* (2014–2015), while Mary Maggic's *Egstrogen Farms: A Transgenic Chicken Commercial for Women* (2015) critiques the nexus of functional foods or "nutraceuticals" and fertility diet cultures.[1] Fraught indigestions and anticonsilient practices across the arts, medicine, and critical theory show how food and medicine cultivate the body like soil. If the metabolisms of cancer and fertility are systems responding to environmental conditions,

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then calls for individual dietary change enter into complex dialogue with environmental justice concerns. The public diets of artists reveal how nutritional, medical, and cultural environments support and inhibit the metabolisms of tumors and fetuses alike.

Many of these DIY practices take the form of kits, evoking Fluxkits, meal kits, and chemistry sets. Kits encapsulate, reassemble, and open up particular lived experiences in order to negotiate tension between authority and freedom. Kits are sensory; "users of Fluxkits are linked to their physical environment through a sensory encounter with it," writes Hannah Higgins, who shows how direct experience informs Fluxkit practice. Kits are not *about* something; they *are* something.[2] Although an expert manufacturer has assembled the kit, kits invite subversion once they reach amateur hands. The choices individual kit users make could be interpreted within an anarchist understanding of "mutual aid." Mutual aid "makes the difference between being an anarchist who acts out of care for the collectivity and being a neoliberal lifestylist committed to healthism," writes philosopher Alexis Shotwell, who argues for an expansive and multispecies understanding of Pyotr Alekseyevich Kropotkin to argue that food politics will only flourish in relational spaces of mutuality.[3] Anticancer and fertility diets negotiate tensions between care for the community and the neoliberal lifestyle.

Diet has become a site of hopeful agency for women trying to become pregnant. If I understand pregnancy as "the ultimate ultramarathon," sitting at "the far end of our metabolic capacity," a specialized diet becomes critical to preparing for this extreme endurance event.[4] Science writer Rebecca Fett's *It Starts with the Egg* exemplifies this genre of the fertility diet literature.[5] Written from personal experience, Fett documents how she improved steep IVF odds with supplements and nutrition, eventually giving birth to two boys; her author photo features one of her children. Physicians Jorge Chavarro, Walter Willet, and science writer Patrick Skerrett's *The Fertility Diet: Groundbreaking Research Reveals Natural Ways to Boost Ovulation and Improve Your Chances of Getting Pregnant*, complete with a cover illustration of two peas in a pod, joins Fett's book and innumerable other books, blog posts, cookbooks, and recipe archives to promote a fertility diet that strongly resembles the anticancer diet (avoid trans fats, emphasize iron-rich leafy greens, and stay hydrated).[6]

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Chicken eggs proliferate in the visual language of fertility diet books. The cover of *It Starts with the Egg* centers a round-cheeked white infant emerging from a perfectly balanced oversize chicken eggshell, and the book's website includes a background image of chicken eggs rolling around on a wooden surface. Eggs connote fertility in countless ways, from Easter egg hunts to high school students caring for fragile egg "babies" as a taste of parental responsibility.

Chicken egg fertility is more than symbolic. Feminist art collective subRosa shows correspondences between chicken and women's cultures, asking, "Why are women like chickens and chickens like women?" Both chickens and women have been "permanently confined indoors," are capable of mechanized reproduction, and are susceptible to "hysteria," be it "female hysteria" or "avian hysteria."[7] Scholar Susan Squier argues that chickens and women coexist in "mirror relation" in agricultural contexts, with poultry revealed to be "liminal livestock" who traverse domestic, farm, and pharm spaces.[8] Scholar Donna Haraway remembers a formative science education experience that crystallizes chicken semiotics: "Fertile eggs in school biology labs . . . gave millions of young hominids the privilege to see the shocking beauty of the developing chick embryo."[9] With their heartbeats and promise of life, chicken eggs are central to the visual culture of fertility diets, and must be central to metabolic readings of fertility diets.

Maggic's *Egstrogen Farms* presents a glossy video commercial for a functional fertility food, Egstro-Eggs, sold in branded egg carton packaging that recalls the packaging of nutraceutical eggs enriched with omega-3. Egstro-Eggs move chicken eggs and breakfast foods from the visual culture of fertility diets into speculative lived experiences.[10] Maggic and collaborator Byron Rich adopt diverse approaches, developing everything from protocols for extracting estrogen from urine in the home kitchen (see chapter 5 for more on *Housewives Making Drugs*) to speculative fiction scenarios that follow subRosa and Squier's links between chickens and women.

The commercial features a wholesome white couple wearing plaid shirts and struggling with fertility. Consuming the eggs of genetically engineered chickens raised in idyllic conditions will "allow you to ovulate as frequently as chickens do," illustrated by diagrams of a chicken

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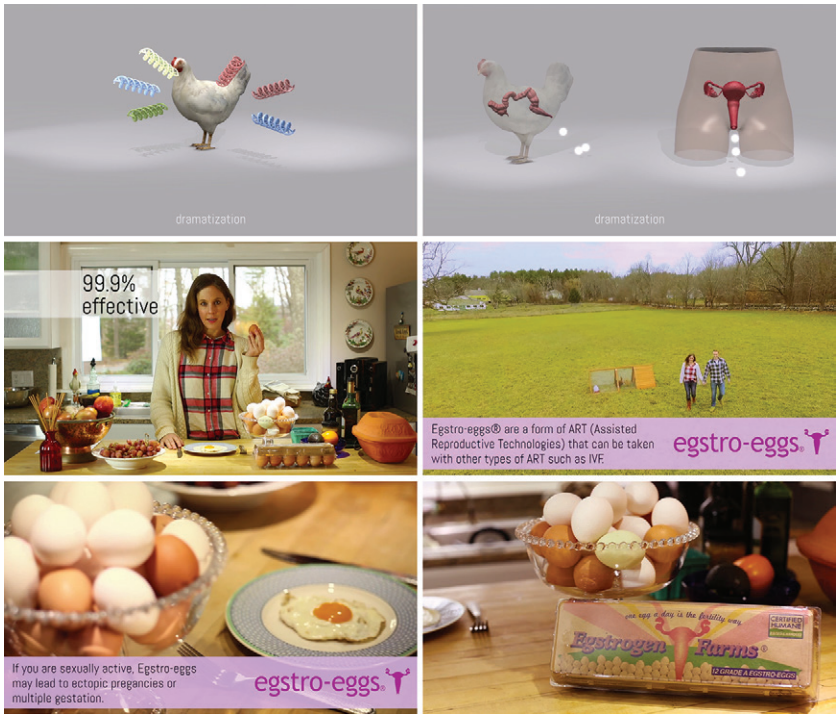
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egstro-eggs
Egstrogen Farms

FIGURE 3.1
Mary Maggic, *Egstrogen Farms*, 2015. Video. Courtesy of Mary Maggic.

and woman's pelvises dropping large quantities of glowing white eggs in tandem. Egg cartons are labeled with an illustration of a pile of chicken eggs beneath a pink womb and fallopian tubes. Egstro-Eggs proclaim, "One egg a day is the fertility way," and viewers are told, "don't settle for the eggs you were born with."[11] Plausible medical disclaimers are superimposed over images of chickens enjoying wide open spaces. The scene changes to a large suburban kitchen where the commercial's would-be mother digs into a fried Egstro-Egg. *Egstrogen Farms* does not explicitly declare its nutraceutical eggs to be part of IVF treatment, but Maggic's emphasis on the quantity and frequency of ovulation suggests that Egstro-Eggs are adjacent to the hormones taken by egg donors.

Chickens are untroubled by infertility; the *Egstrogen Farms* commercial animates eggs bouncing out of chicken bodies with reassuring, rapid regularity. When women are invited to be more like chickens through

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regular consumption of their visually cognate eggs, this references the real, not speculative ways in which fertility treatments for women take their cues from farming. Chavarro, Willet, and Skerrett observe how links between diet and fertility are better understood in commercially farmed livestock than in women, while Squier finds that "women's reproductive timing has been managed and standardized toward the goal of increased fertility using techniques adapted from animal agriculture and based on work with laying hens."[12] *Egstrogen Farms* brings women and chickens into the same pasture, promoting face-to-face encounters with research animals. Patients cuddle the genetically modified chickens responsible for their therapeutic intervention. The fertility dieting mother holds a chicken in her arms, and the potential father, not obliged to eat Egstro-Eggs and not burdened by fertility diet protocols, cavorts with another chicken in the closing shot of the commercial, as if the two are playing catch. The couple nurture and parent the chickens as proxies for children.

The fertility benefits of Egstro-Eggs are speculative, but chickens serve as research animals in experimental settings that are not speculative. *Egstrogen Farms* builds on the established capacities of chicken eggs to host pharmaceutical technologies.[13] Recalling OncoMouse, the first research animal to be patented, laying chickens have been leveraged in cancer research, serving as bioreactors to produce proteins critical to cancer therapies such as Herceptin and Avastin.[14] SubRosa traces a history of treating chickens as drug factories, finding sisterly bonds between "Britney, the genetically engineered pharm chicken," Dolly the sheep, and their superstar namesakes Britney Spears and Dolly Parton.[15]

As life-forms, cancers have more in common with babies than might be comfortably acknowledged. Maggic's *Egstrogen Farms* chickens are in dialogue with IVF donors and da Costa's kale and laboratory mice; everyday staples such as eggs are subject to the same fraught caring and killing relationships witnessed with laboratory mice. Cancer and fertility share more than pharming practices. Artist and anthropologist S. Lochlann Jain finds little to go on when they evaluate their decision to undertake hormonal treatment to donate eggs to their partner. Might this treatment and the largely unregulated IVF marketplace have anything to do with their subsequent cancer, and the cancers of a significant number of people in their cancer support group? Long-term studies of egg donors do

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not exist. Instead of documenting evidence for their suspicions, Jain sits with "proof's opposite," an anticonsilient "ignorance about the health consequences of donorship."[16] Jain's progress from IVF patient to cancer support group participant offers one path into these discomfiting relationships. Da Costa's *Cost of Life* projects and Lu's *Cancer Baby* transform different pathways: cancer expresses its exuberant agenda, singing and dancing, invisible, unnoticed, and coercive.

## The Cost of Life

Da Costa had been negotiating with cancer for many years when she died in 2012 at thirty-eight years old.[17] Her art practice did not address these negotiations until her cancer became active in her brain. While working with the brain tumors, she developed artistic methods for articulating the political life of cancer. Her partner, artist Robert Nideffer, describes how she found "a place from which to provoke and reflect without it, as she said, 'being about me.'"[18] While making *Dying for the Other* (2012) and the *Anti-Cancer Survival Kit* (2013), da Costa moved from remission to metastatic disease and then from death into posthumous production.[19]

Embracing "public amateurism," citizen science, and biohacking, da Costa's projects educate visitors with public performances, workshops, and interactive installations, and develop collaborations between humans, animals, and machines.[20] Her last works, grouped under the umbrella project title *The Cost of Life*, examine anticancer diets as a metabolic interface between plants and health. In addition to the two works that are detailed in this chapter, *Dying for the Other* and the *Anti-Cancer Survival Kit*, *The Cost of Life* includes *The Life Garden* (2011), a living garden of plants known for their anticancer properties, and *The Delicious Apothecary* (2012), a medicine cabinet stocked with dried and preserved herbs ready to be used in a series of anticancer cooking classes designed to alter the eating body's nutritional environment and influence metabolism, growth, and change.

"Cost-benefit equations" in cancer data analysis preoccupy Jain's consideration of the cost of life.[21] To navigate cancer's complex cultural entanglements, Jain draws from their lived experience of cancer treatment to propose an "elegiac politics."[22] Even as individual deaths matter,

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FIGURE 3.2
Amy Claire Mills, *Unsolicited Advice!*, 2021. Textiles. Installation view, Firstdraft, Sydney. Photo credit: Zan Wimberley. Courtesy of Amy Claire Mills.

elegiac politics foreground environmental toxicity to resist the neoliberal impulse to blame cancer patients for their choices, lifestyles, and illnesses. Fertility and anticancer eating are supported by communities with opinions. Beyond conventional medical treatment, innumerable blog posts, diet plans, expensive therapeutic options, and supplements frame anecdotal evidence and health advice from friends, family, and total strangers.

Artist Amy Claire Mills investigates the ableist, individuating, and less supportive politics of these support systems with *Unsolicited Advice!* (2021), a collection of soft pillows and quilts. Made from iridescent, sequined, and shiny fabrics, the intricate ruffles, appliqué work, and contrasting piecing center quotations of the "awkward, and often insensitive unsolicited advice I am given after people discover I am disabled."[23] Most of the pillows feature unsolicited advice about diet and lifestyle choices. Although the series was not made in the context of a cancer diagnosis, many of the suggestions Mills documents—"Bone Broth," "Dieting," "Aromatherapy," and "Juice Cleanse"—demonstrate what Jain describes as the "survival rhetoric and pink kitsch" of anticancer discourse—rhetoric

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that impacts the lived experience of cancer.[24] The comfort of quilts and pillows contrasts with the subtle and less subtle aggression underpinning the unsolicited advice memorialized on each item: "Have you tried?" "Change your attitude!" and "You'll be fine!" Vague platitudes and prescriptions sidestep the reality of illness and disability. When Mills appliqués the unsolicited advice she has received over the years, her pillows and quilts become elegiac by forcing Jain's "injunctions to hang in there" to circulate in critical contexts that deny ableism the last word.

Da Costa's *The Cost of Life* projects align with Jain's elegiac politics and Mills's *Unsolicited Advice* in their "anticonsilience."[25] Consilience signals agreement and concordance, implying that evidence from many sources might be brought together to strengthen conclusions across disciplines. The anticonsilient does not simply interrupt; for scholar Elizabeth Wilson, dissonance allows the harms and hostilities present in feminist praxis to coexist and complicate one another. Scholar Sara Ahmed joins da Costa, Jain, and Wilson when she insists on anticonsilience with her assertion that to be "willful" is "to be willing to announce your disagreement, and to put yourself behind it."[26] Although writing from different medical and social contexts, Wilson and Ahmed offer anticonsilient feminist support to Jain's insistence that they "make [cancer] *more* difficult, . . . make it everywhere, . . . proliferate its meanings so that all those . . . flowcharts and path reports and injunctions to hang in there don't get the last word."[27] Jain undertakes a metabolic reading of cancer at the societal level to build a politics driven by bodily capacities to grow and metabolize wanted and unwanted materials.

Da Costa's *The Cost of Life* projects reveal specific digestions to be serious acts of resistance. The guts digesting da Costa's anticancer meals are organs of mind that refuse accord and agreement, allow for unhappiness and rage, and topple accepted hierarchies of medical authority. Animated by bile, toxicity, frustration, and in da Costa's words, "more than even I can take," *Dying for the Other* and the *Anti-Cancer Survival Kit* enact a feminist politics that does not deny or reject but instead metabolizes and transforms death and fatal harm.[28]

Da Costa's *Dying for the Other* presents three channels of video footage from testing environments, including laboratories, hospitals, kitchens, and living rooms. The three channels fade in and out, occasionally going

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FIGURE 3.3
Beatriz da Costa, *Dying for the Other*, 2012. Photo credit: Beatriz da Costa.

dark, accompanied by an ambient, subdued soundtrack. The installation layers everyday therapeutic gestures in the lab and at home. Da Costa performs physical therapy exercises, chops vegetables, and walks up and down hospital corridors. These labors accompany footage of tumorous pink mice wriggling in their cages, living and dead mice weighed and handled by researchers, and the materials of laboratory and medical work—test tubes, petri dishes, and scalpels. These collected activities and productivities attend to shared suffering, remedy, and harm.

To better understand cancer's appetites, I look to my and artist Catherine Lord's tactics for viewing *Dying for the Other* alongside curatorial strategies for its display. Cancer's status as "new life" or a separate and growing entity inside the body connects anticancer diets with fertility diets, even as they compose different nutritional environments, seeking to inhibit or encourage the proliferation of new tissues. As installed at *DeMonstrable*, a 2015 exhibition curated by Oron Catts with Jennifer Johung and Elizabeth Stephens, da Costa's *Dying for the Other* triptych quietly cycles through its thirteen minutes at one end of a cavernous dark space.[29] Lu's *Cancer Baby* sparkles opposite. *Cancer Baby* bounces out of a large wall projection, metastasizing throughout the room with sculptures and prints that extend the fluorescent palette of a frenetic cheerful dance animation featuring anthropomorphic *kawaii* tumors. Big-eyed colorful tumors sing:

> Cancer cancer cancer cells!
> We are happy cancer cells!
> We are living cancer cells!
> We stay inside your body!
> We are big family!
> Sister and brother!!!

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We glow [*sic*] up very very fast!
Super super fast!
You will never notice that![30]

A Dance Dance Revolution mat invites a space for physical engagement with the upbeat music video. In her nuanced reading of *Cancer Baby*, scholar Jennifer Dorothy Lee focuses on relations between cancer, video games, and Lu's preference for the term "creator" (and disavowal of the words "artist" and "feminist").[31] *Cancer Baby* opens transnational and political flows leading in and out of Lu's context in contemporary China. Lee enacts a metabolic reading practice when she rejects logics of "representation" in favor of "the embodied consciousness of the viewer sucked into Lu's transformative process."[32] Body image is "sucked into" body process.

Despite its proximity to the exuberance of *Cancer Baby*, *Dying for the Other* holds the other end of the room in a low-volume vacuum. In the same instant, da Costa splits a pill on the left channel while the camera stays close to dead mice in the center; to the right, da Costa stands at her kitchen counter and chops dark leafy greens. Some minutes later, chopped vegetables mirror dissected animals while handlers attend to the mice and da Costa with tenderness and care. The support offered to da Costa as she walks down a hospital corridor recalls the gentle efforts of laboratory technicians to reposition wriggling mouse bodies when reconfiguring a cage. That same tenderness returns when pinning dissected mouse bodies to open and display their tumors. Material semiotics of cancer unfold across research organism lifeworlds. The pill shares metabolic pathways with food, allowing the dead bodies of research animals to nourish da Costa's dying body. Cut together with kale, medicine becomes food, and food becomes exposure—an "immersive environment."[33]

As I sit on the floor, pen and notebook at hand, determined to endure the entire thirteen minutes of da Costa's triptych with appropriate scholarly focus, I am grateful for *Cancer Baby*. I imagine da Costa enjoying the dark humor of *Cancer Baby* and its proximity to and effect on her work. Writing this chapter, I flip back and forth between a rough cut of *Dying for the Other* and my text, unable to stay with da Costa's delayed reflexes and exhausted body for more than fifteen seconds at a time. During a panel discussion about the *DeMonstrable* exhibition, Catts recalled how

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da Costa knew the work was challenging to watch and should be offset.[34] When showing the video's early edits, she made sure to have another screen active nearby for viewers to turn to when they needed a break. The moment of looking away becomes an integral part of viewing the work. When I look away, I break uneasy connections between da Costa's body, the bodies of the mice, their food, and assisted living and dying as lively processes. My peripheral vision undermines my attempts to stay focused on one scene versus another. The triptych's structure forces me to watch certain scenes by either collapsing into a single frame or iterating three identical views. In this way, the three channels compel visitors to develop viewing tactics if they stay longer than a moment or two. My concentration and gaze translate into ethical choices about how to engage with art, research animals, food, and illness.

Lord reflects on her viewing tactics in a panel discussion on *Dying for the Other* shortly after da Costa's death. Lord focuses on the mice rather than "my colleague re-learning basic cognitive skills and doing yoga light." She chooses the mice because "it is less painful emotionally, but also because it is somewhat erotic"; their naked, bulging, lumpy bodies evoke genitals, and their inert cylindrical corpses become textured dildos.[35] I, too, follow one pathway through the triptych, but different from Lord, I stay with the kitchen scenes. Unlike her struggles with speech, walking, or the rehab exercises Lord describes as "yoga light," da Costa confidently engages with vegetables. Her hands move with the same assurance as those of the cancer researchers, knowing what tools are needed and when. I stay with the kitchen scenes for this confidence. In sympathy with Lord following the mice, it is less painful emotionally.

Haraway's viewing tactics follow research activities, finding that "kale are research organisms . . . every bit as much as that mouse."[36] I turn away from mice to kale, and that look cuts, recalling how mice and kale go under the knife together in anticancer research-creation. If the bald pink mice have materially moved into da Costa's body through a deft game of metabolic cat's cradle, so too have Lu's cancer babies. Cancer babies emerge from kidneys, brain, uterus, breast, stomach, heart, and bladder. A scene from *Dying for the Other* where a researcher chases a pea-size bouncy tumor around a petri dish with a scalpel recalls the rubbery resilient buoyancy of Lu's sculptures. I imagine that dissecting one of these round

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soft-looking blobs would involve similar difficulties with pinning down and stabilizing the material. Da Costa peers into the realms of tiny cancerous messmates at her table while Lu makes them large. Cancer babies are growing very, very fast throughout da Costa's body; they are happily proliferating as they bounce between the two installations, between screens, and between mice, kale, and people. Lu's babies cry, "Please don't kill us!" while da Costa does all she can to slow their progress.

Da Costa frames *Dying for the Other* in terms of mess, the mess that implies disorder, and mess as a condition of possibility. She addresses "the messiness embedded in the practice of maintaining one kind of life by killing another" and "attempts to give this messiness a form that disallows simple rationalization."[37] As Haraway reminds us, "mess" can be a place, a site where multispecies ensembles eat together and "nourish indigestion." Anticonsilient indigestions flare up as metabolisms struggle to nourish some types of tissue but inhibit the appetites of cancer. In *Dying for the Other*, the mess spreads from kitchens to laboratories and hospitals, each a scene of indigestion and pharmacokinetic nourishment. Da Costa aligns her work with Haraway's to draw out the cancer patient's messy kinship with mice. Haraway explains that while she does not categorically oppose laboratory research with mice, she insists that such research happen "face-to-face, inside the mortal knot of becoming with other animals"—a position that forces patients and researchers to acknowledge that while mice are useful, even instrumental, they are also "companion species."[38]

Through juxtapositions, edits, and cuts, *Dying for the Other* holds onto mice as companion species by metabolizing mice, kale, people, and pharmaceuticals. Research animals live, die, are sacrificed, and are together and apart in their lives and deaths as they move across bodies, including da Costa's, each other's, and their researcher caretakers. Pharmacokinetic trace and touch prevent these bodies and psyches from inhabiting essentialist, consilient identities. Mouse bodies touch human bodies through medicine, research, the gut, drug metabolism, and a willful, anticonsilient refusal to turn away from what Haraway names "sharing suffering."[39]

Research animals share more than their disease with patients, as seen in artist Kathy High's *Embracing Animal* (2004). High purchased laboratory rats engineered to have preexisting conditions similar to her own.

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She treated the rats as she treats herself, with alternative medicines. She was "curious as to what transgenics meant in an embodied way, and how these animals reacted to their condition."[40] Returning to OncoMouse, Haraway frames relations with her sister, the OncoMouse, in terms of responsibility. Because of her role in breast cancer research, she "will someday owe to OncoMouse™ . . . a large debt."[41] High works to repay this debt by meeting immunocompromised rats "face-to-face" and testing how the nutritional environment she has created for her illness might benefit the health of her instrumental companions.[42] Da Costa, High, and Haraway share life history, diagnoses, and body processes with research animals. All three are enfolded in da Costa's title, *Dying for the Other*.

Da Costa witnesses the cancer research mice die for her as she dies in physical and pharmacokinetic proximity to them. Through her video documentation, da Costa makes sense of how her death process cycles through research agendas and mouse lives. High and her rats along with Haraway and da Costa and their mice are sisters and messmates, eating food and pills in the presence of one another, experimenting with metabolic responses to "sharing suffering" and care.[43] *Dying for the Other* manifests these relations by juxtaposing a close-up of da Costa splitting a pill with a sacrificed mouse with a bag full of kale. Eating in the anticancer mess reveals the pharmacokinetic capacities of kale and all foods: diets are ambivalently prescriptive.[44] Kale and medicine infect one another with ambiguity about the beginnings and endings of bodies, diseases, and treatments.

## *Anti-Cancer Survival Kit*

While developing a database of anticancer edible plants and recipes to help cancer patients with their dietary interventions, da Costa read physician David Servan-Schreiber's *Anticancer: A New Way of Life*, the book most responsible for introducing "anticancer" as a household word. Servan-Schreiber, a psychologist and brain cancer patient, describes connections between mind, body, and food as "terrain"—metabolism becomes a landscape.[45] Many thinkers and writers have adopted landscape metaphors for the microbiome, from science bloggers to biologists to philosophers.[46] Parallels between soil and the multispecies formations that allow

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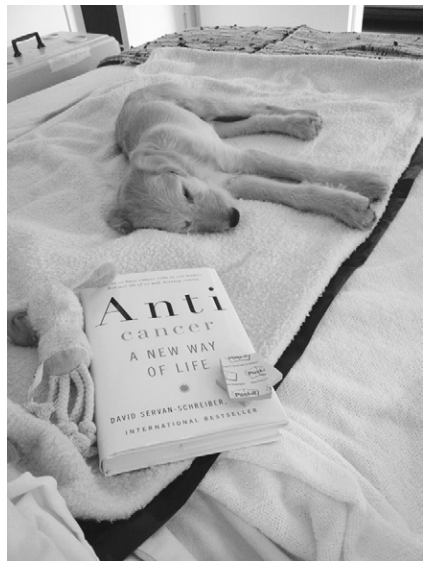


**FIGURE 3.4**
Beatriz da Costa's dog Lucinha with her copy of *Anticancer: A New Way of Life*. Photo credit: Beatriz da Costa.

bodies to digest their food take on additional significance when linked with anticancer and fertility diets. "Terrain" suggests the soil where crops grow: a body becomes a field. "Improved terrain" evokes a vibrant and fecund place that supports life—a more agriculturally receptive metabolic landscape.

Terrain metaphors are vulnerable to the purity politics that animate popular books such as Michael Pollan's *Food Rules*, which scholar Kim Q. Hall describes as "alimentary ableism," or "clean eating" diets ranging from Jordan Peterson's all-meat diet to vegan, paleo, raw food, and other diets described by Shotwell as "food individualism."[47] How might anticancer eating avoid the pitfalls of alimentary ableism and stay with food's relational and mutual potential? Bodies are never isolated; eaters cannot control pollution, climate crisis, and sociopolitical factors that influence terrain. Da Costa locates the politics of terrain in the kitchen and isolates specific techniques with the kit format. The kit transforms food preparation activities that may at first glance appear to be isolated and individual into collective and collaborative structures.

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**Figure 3.5**
The author's *Anti-Cancer Survival Kit* components (minus grow light).

The *Anti-Cancer Survival Kit* was realized posthumously with the help of immediate collaborators Crys Moore, Maria Michails, Pamela Mendoza, Johnny Lu, Donald Daedalus, Frank Peter, Michelle Fuerst, Robert Nideffer, Jamie Schulte, and Lucinha (da Costa's therapy dog) as well as contributions from 118 RocketHub crowdfunders.[48] The survival kit's core activities can be seen in *Dying for the Other* while da Costa works in her kitchen, unpacking and prepping her groceries. The kit format makes food preparation both easier and political by holding space for the anticancer diet efforts of a distributed collective. Shotwell's framing of mutual aid "as a practical, collective approach to keeping people alive in moments of emergency and crisis" helps me understand the *Anti-Cancer Survival Kit* as not only made collaboratively but also designed to generate new collective anticancer social formations through the practical work of food preparation.[49]

As with many of da Costa's multiplatform multimodal projects, *Anti-Cancer Survival Kit* encompasses online databases, recipe archives, and

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utilitarian objects such as ceramic mugs, grocery bags, wooden spoons, seeds, tea, grow lamps, cutting boards, and flower boxes. Described as "a multimedia art kit for people living with cancer, their family and friends, and anyone else who wants to avoid getting cancer in the first place," the kit offers methods for testing and sensing food's pharmacokinetic effects across metabolisms and environments.[50] *Anti-Cancer Survival Kit*–branded cutting boards and wooden spoons remind eaters at every stage of food preparation of how food shapes and guides exchange between body and environment.

Writing about biotech kits that allow users to culture cells and create genetic modifications at home, da Costa observes that kits and cooking have much in common: "Similar to the pleasures of cooking one's dinner or fixing up one's house, the act of making, building and simultaneously learning seems to be an appealing and desirable way of spending spare time."[51] Here, the kit connotes pleasure, leisure, the nicer aspects of housekeeping, and given the biotech content of the kits da Costa refers to, something more: an element of subversive knowledge transfer. Beside da Costa, elsewhere I have considered the politics and histories of kits in food art, from Fluxkits to contemporary DIY movements, finding that "kits and recipes encourage the movement of protocols and substances from laboratory to kitchen and back again, remaking and connecting professional and amateur spaces."[52] That a kit traverses these spaces might seem incidental, but this freedom of movement between different sites of production unsettles the kit's claim to expert authority and undermines the separation of the home from the factory or laboratory.

The *Anti-Cancer Survival Kit* facilitates distributed collaboration between distant participants. The kit's production process contributed to its capacity to network kitchen activities. Networked coworking would not be remarkable or unusual in the technology-art space da Costa inhabited, but working on the kit in this way allowed for posthumous completion. Like Ahmed's killjoy survival kit, the collectivity that gave the *Anti-Cancer Survival Kit* posthumous life recalls the collectivity that Ahmed depends on: "Other killjoys need to be part of our survival kit" to draw from "the experience of having others who recognize the dynamics because they too have been there, in that place, that difficult place."[53]

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Moore wrote about her work on the *Anti-Cancer Survival Kit* in her essay "Art in the After," asking, "How does one continue an artist's work posthumously?" She observes that "the kit was motivated by Beatriz's own experiences and desire to share information that she wished she'd received earlier on." Moore helped launch the crowdfunding campaign that would finance the project; da Costa died a few weeks after the launch. Moore continued working with the team da Costa assembled before her death, chronicling the challenges of installing and exhibiting the project without da Costa. With mixed feelings, Moore agreed to display the kit in glass vitrines, but noted a "tension between the vitrined display and Beatriz's intentions."[54] Here, after eating joins after life. Thwarting the active transformational processes of metabolism and digestion, vitrines seal off and block the impact of a work activated by touch, shared surfaces, and distribution across far-flung cometabolizing kitchens. In contrast to vitrine display, the kit's dispersed, circulating, and networked form captures the practical everyday utility of the items that mattered to da Costa and her team. The vitrine interrupts Higgins's insistence that kits are a thing, not about a thing. Glass stops the movement, loops, and spirals that characterize after eating.

Even though few of the components are unique or one of a kind, because they have been branded with the *Anti-Cancer Survival Kit* logo, each piece of the kit enacts a conceptual shift whenever participants use them. Evoking the anarchist symbol, the "A" for anarchism piercing a circle representing the current social order or current world, the *Anti-Cancer Survival Kit* logo crosses a carrot over a spoon, overlaid onto what might be a chain of monomers with an open branch. In 1927, cancer researcher Boris Sokoloff wrote about "The Problem of Cellular Anarchy," asking after the relationship between cellular membranes of cancerous tissues and tumor malignancy.[55] Although Sokoloff's term has disappeared, and likely referenced forms of anarchy different than mutual aid, "cellular anarchy" acknowledges cancer's political life and how it pierces the current social order. Anarchist struggle at the metabolic level unsettles pharmacology, medicine, and even anticancer's leafy green set of longed-for, ordered certainties. The *Anti-Cancer Survival Kit* enacts this politics by distributing tools for practicing anticonsilient, antiauthoritarian models of care.[56] If I use a mug or cutting board without the *Anti-Cancer Survival Kit*

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FIGURE 3.6
Pamela Mendoza, illustrator, logo for *Anti-Cancer Survival Kit*, 2012.

logo, I probably won't think about whether or not my tea or food has anticancer properties. If I use the same objects from the kit, the simple addition of the project's logo makes me consider the follow-on effects of adding industrially farmed milk and white sugar to my tea and fills me with the sometimes-disappointing knowledge that I should be using the cutting board to chop kale instead of slice cheese.

The association of "anticancer" with diet has penetrated popular consciousness to such a degree that many people, including those who have not read Servan-Schreiber's book, now understand how diet matters to cancer outcomes. Even people like me whose cancerous cells lie dormant for the moment may have an awareness of anticancer dieting. But what kind of diet is an anticancer diet? Servan-Schreiber would prefer that his approach to cancer treatment be seen as complementary to traditional treatments, yet his own narrative of understanding the terrain model and researching alternative pathways has an anarchist sensibility. The process demanded that he stretch his medical training in new, counterintuitive directions. He learned about terrain from a friend who practices alternative medicine and ignored her first attempt to query how he was caring for his body as one component of a complex landscape.[57] It took a relapse

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FIGURE 3.7
Anarchism symbol by Enon.

of his brain cancer before he stopped eating daily bagels. He became sensitive to the appetites of his illness and how metabolism responds to nutritional environment. Writing in a private blog designed to disseminate news of her health to friends and family, da Costa narrates a complementary moment of struggle with food. In the context of unexpected weight loss, a further ten pounds after an initial ten pounds following surgery, da Costa observes that "since food is one of the few things that I can do to at least attempt to keep all those nasty micro-metastases in check, 'ordering in pizza' isn't such a good idea in my case."[58]

In the *Anti-Cancer Survival Kit* and this blog post, da Costa recognizes the gut as an organ of mind: the stomach links to brain cancer. Gut politics—bile, melancholia, and indigestions—already pierce orderly consilience. Granting the gut the status of mind undoes some of the brain's authority. Distinct from the abstract processes of cognitive understanding, thinking guts allow for practical culinary possibilities; edible choices shift into mutual and collective forms of care.

Yet the anticancer position is a complicated one. "Anticancer" and "survival kit" modify one another in at least two ways. Kit users seek to survive cancer, but in the process, they must survive anticancer, which

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includes pink ribbon campaigns, well-intentioned health advice, and expensive, competing therapeutic options. Curing and assisting are always positioned in relation to living and dying, supplementing one another. Kale and laboratory mice, both research organisms, belong to the cancer mess and cost life. For da Costa, Servan-Schreiber, and *Anti-Cancer Survival Kit* funders, diets and digestions support and imperil the entangled lives of bodies and their illnesses. Food is exposure and could even be termed "metabolic therapy."[59] Da Costa shares this outlook when she reminds her friends and family that she shouldn't eat pizza because, according to Servan-Schreiber, its ingredients could (recalling his prerecurrence bagels) strengthen the appetites of her illness.

Da Costa's post about not eating pizza coincided with her carers and community organizing a "meal train" to deliver food to her home. Conventional meal kits and delivery services such as HelloFresh are increasingly leveraged by cancer patients and carers to make food a site of mutual aid. Aid comes from the kit format and time saved by portioned amounts as well as from the internet-facilitated purchase options that allow a community as far-flung as da Costa's crowdfunders to support her both from a distance and instantly. These networks are ad hoc and paid for out of pocket. Outside the hospital and related facilities serving hospital food, food remains largely unsupported by the superstructures that support medicine.

Understanding kale, eggs, and mice as kindred research organisms recalls the framing of the body as terrain as well as Landecker's conception of food as "exposure" and environment. Metabolism can no longer be regarded as an engine consuming transubstantiated caloric fuel; instead, metabolism must be understood as the relational responsiveness of multispecies bodies to nutritional surroundings: "if the body is open to the environment, then it is open to environmental intervention."[60] The nutritional environment of *Dying for the Other* contains pills, greens, mice, and their often-overlooked synthetic laboratory diets. *Egstrogen Farms* aligns fertility-seeking women with chicken bioreactors frolicking in expansive pastures. Approaching diet as terrain blurs disntinctions between nutrition and pharmacokinetics. Bodies must be cultivated like soil. Evoking mycelial networks, this cultivation extends to the bodies of research organisms such as mice and chickens, whose specialized feed

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sources and diets are critical variables (omega-3 eggs result from feeding flax seeds to chickens). Servan-Schreiber and da Costa position the gut as a first responder to cancer, and Fett and Maggic do the same for fertility: food can shift the terrain or environment of a body while holding conflicting forms of cellular life in productive tension.

Servan-Schreiber had to acknowledge the life of his illness before he could understand his body as terrain. Da Costa's turn to anticancer diets works through similar understandings about her art practice. With her final projects, da Costa acknowledges her cancer not only as the subject of and content for an art practice that had rigorously resisted personal confessional modes but also as a lively entity with the potential to form political connections across species and life-or-death boundaries. Jain reminds us that such alliances will be difficult "as long as cancer remains an individual rather than a communal disease."[61] Da Costa's death should not be construed as a failure to work with her cancer productively—and neither should Servan-Schreiber's (Servan-Schreiber died in 2011 after a recurrence of the brain cancer he describes in his books). In life and death, da Costa and Servan-Schreiber articulate an anticonsilient and elegiac politics that makes cancer a communal disease. Kitchen surfaces mobilize to address the terrain of bodies and the larger sociopolitical forces that influence them. Their work shifts the conversation away from isolating stigma, and toward multispecies and mutual collectivities that are activated by an awareness of the appetites of illnesses. Anticonsilient feminist diets find eggs, pharmaceuticals, kale, and nutraceuticals swimming in the same stomach.

From da Costa's kitchen to parents-to-be visiting *Egstrogen Farms*, these feminist diets rely on "surface encounters" to develop food and eating as collective environmental concerns. Scholar Ronald Broglio argues that animals have been compressed into "a thin layer of animal world as a life on the surface of things." While this flattening into surface has permitted animal cruelty, surface encounter might be "turned against its negative uses" so that "the surface can be a site of productive engagement."[62] This thin layer of animal world productively travels to a kitchen context. Tumorous mice, egg-laying chickens, and women's embodied illnesses and fertilities touch through the surfaces of contemporary art and anticancer and fertility diets. As da Costa serves up a plate of research

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organism greens, *Anti-Cancer Survival Kit* triggers activities of mutual aid that are materially bound to the surfaces of daily life, such as cutting boards, apron strings, and seedlings. The scattered presence of the kit across households and states of health shares life history with the terrain of its users, producing digestive networks and collective nutritional environments. Da Costa's death pushes *Dying for the Other* and *Anti-Cancer Survival Kit* into the productive friction of surface encounters between the living and dead.

What do I do when I chop kale or slice cheese on my *Anti-Cancer Survival Kit* cutting board? I cultivate my terrain and connect to the terrain of other kit users; I remind my thinking gut about how food and cancer relate; I remember Shani; and I feel grateful for the dormancy of the cancer cells seeded throughout my flesh. I am mindful of the carcinogens permeating the environment where my flesh lives, and as an effect of these understandings and affects, I am undone as an individual person with autonomous bodily boundaries. I dwell on surfaces. The world moves through me. The kit's logo, its surface encounters, and the process of preparing food in this material context compel an embodied awareness of cellular anarchy and the appetites of our illnesses. The project challenges easy notions of digestion; food and pharmaceuticals no longer nourish the solitary body of the individual. Anticancer and fertility diets acknowledge how bodies and their proliferating cells share environmental terrain inside and outside the skin. Cancer and fertility patients both "eat for two."

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# II

## Giant Creatures

This second part of *After Eating* opens pathways between body processes, ecologies, and the planetary. Bodies could not process without extended networks that are multispecies, ecological, microbial, fungal, symbiotic, and even intergalactic. How might I sense these networks? Writing about the metabolism of water in 1958, Howard Odum and Charles Hoskin observe that "each day as the sun rises and retires the beautiful green bays like great creatures breathe in and out."[1] Odum and Hoskin describe "community metabolism," the total metabolic activity of a given ecosystem. Giant creatures and "metabolic ecology" help me appreciate how feminist diets extend beyond body image and body process to trouble body boundaries.[2] Diets are ecologies populated by actors and materials that share life history.

Three giant creatures position this part of the book: a molecular creature made of adenosine triphosphate (ATP), a material creature made of human solid and liquid waste, and a figurative creature, the holobiont. Chapter 4, "Adenosine Triphosphate: Metaphors and Materials," critiques analogies of money or currency often used to describe the molecule ATP's function as a metabolic energy regulator. Without ATP, there would be no muscle contraction, no movement to sense, no life. Chapter 5, "Poop Circus," reframes excrement in feminist and queer bioart, installation, and performance practices. Shifting cultural attitudes about waste inspire artists to handle poo differently, working against human exceptionalism and blunt interpretations of abjection to interpret metabolic excretions as communicative pathways. Chapter 6, "Holobionts against Representation," undoes notions of human exceptionalism and individuality. This undoing makes writing and thinking in humanist traditions a negotiation

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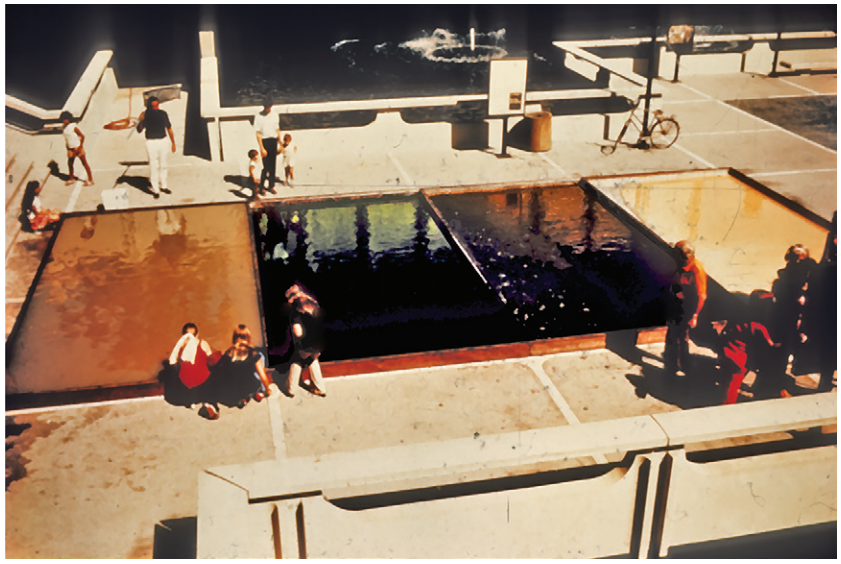

FIGURE II.1
Helen Mayer Harrison and Newton Harrison, *Shrimp Farm, Survival Piece #2: Notations of the Ecosystem of the Western Salt Works with the Inclusion of Brine Shrimp*, 1971. Courtesy of Helen Mayer Harrison and Newton Harrison.

with conceptual extinction events. In conversation with increasingly sophisticated technologies of "prosthetic vision," the holobiont generatively expands links between biological individuality and representationalism to form complex flows between image, process, and boundaries.[3]

Metabolic readings of an early *Survival* work from artists Helen Mayer Harrison and Newton Harrison join three stomachs of artist Anicka Yi to open pathways between material, scalar, and sensory aspects of giant creatures. In 1971, the Los Angeles County Museum of Art maintained a cement garden featuring institutionally sanctioned decorative ponds in the courtyard. These ornamental ponds were dosed with algicides to keep the water from growing cloudy. The Harrisons built *Shrimp Farm, Survival Piece #2: Notations of the Ecosystem of the Western Salt Works with the Inclusion of Brine Shrimp* as an insurgent counterpoint to these institutionally sanctioned ponds, constructing four adjacent waterproofed wooden frames, each ten by twenty feet and just eight inches deep.[4] An alga, *Dunaliella salina*, was introduced to waters of various salinities, encouraging rather

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than discouraging their proliferation. The alga changed the community metabolism of the water, and this had aesthetic effects: "the box then became a three-dimensional color field painting going from blue-green to dark yellowish-green to brick red to white."[5] The Harrisons then introduced brine shrimp, *Artemia* (the same genus as sea monkeys). The brine shrimp continued to tint the water as they consumed the alga. The shrimp and salt produced in the installation were harvested and distributed, making the "survival" constraint in the title more tangible.[6]

Alga and brine shrimp are two of the few organisms capable of surviving the extreme salinity of the water. The alga's changing colors make the community metabolism of the ponds visually striking, evoking both the color field painting the Harrisons reference and the subtle changes Odum and Hoskin notice: "On some days the production exceeds the respiratory consumption, and organic food matter accumulates, but at other times respiration dominates so that the waters and their bottom oozes lose their store of energy."[7] *Shrimp Farm, Survival Piece #2* distills three critical concepts from Odum and Hoskin's creaturely definition of community metabolism: food relationships, energy production, and energy consumption.[8] The color fields visualize and understand community metabolism as interface instead of a factory. Shrimp harvests, recalling bottom oozes, are not produced under conditions optimized for efficiency; instead, they reflect the different variables introduced to the different ponds. Many constrained lives and species survive.

Soon after *Shrimp Farm, Survival Piece #2*, the Harrisons would part ways from the Odums and their collaborators. When Helen Mayer Harrison explains that "we had already disagreed with the Odums by the mid-1970s," she refers to both Howard Odum, cited above, and his brother Eugene Odum, who together worked to establish the field of ecology. Writing in the 1950s, Eugene Odum thought that people were not able to truly damage the environment because the planet's vast resources and cycles would be able to compensate. Newton Harrison describes an encounter with a marine biologist who shared this view, insisting that "you can't hurt the ocean." The Harrisons "thought that was completely wrong."[9] The Odums and this marine biologist have been shown to be devastatingly misguided about the potential harm that human exceptionalism and capitalism might inflict on the environment. And yet I

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want to retain the Odums' evocative figure of the giant creature, keeping their cyclical watery breathing and oozing bottoms. This figure need not subscribe to the "you can't hurt the ocean" philosophy.

Giant creatures invite a shift from body image to body process at an ecological and planetary scale. If the "subject" could be replaced with the giant creature, "ingestive" versus "digestive" subjectivity would transform linked definitions of the body and understandings of social change.[10]

These scale shifts both mirror and explode the questions about body image and body process asked in part I. Submerging myself in Yi's *Maybe She's Born with It*, *ALZ/AZN*, and *Lapidary Tea Slave* (2015), I float in a dim room populated by three large, clear, vinyl orbs enclosing person-size forms assembled from flowers, with each flower fried in tempura batter and then fixed with resin. Dripping and trailing petals, half-formed branches suggest vestigial limbs. Ambiguous surfaces evoke proliferating or decaying microbes, kudzu, and coral reefs. The bladders gently pulse as fanned air supports their shapes. The smell of tempura and flowers escapes the resin and the vinyl membranes to penetrate the noses and lungs of visitors.

FIGURE II.2
Anicka Yi, installation view, *7,070,430K of Digital Spit*, Kunsthalle Basel, 2015. Courtesy of the artist and Kunsthalle Basel.

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Yi's stomach sculptures sidestep beauty and judgment to confront leaks across bodies and membranes. A "metabolic aesthetic" accounts for Yi's practice. Scholar Rachel Lee identifies a "lexicon indebted to biochemical and sensory insights."[11] Yi refers to her sculptures as "stomachs," shaped and filled to resemble saclike organs that, in Yi's words, "convey how important the stomach's intelligence is for me."[12] *Maybe She's Born with It*, *ALZ/AZN*, and *Lapidary Tea Slave* exude the lively decay and material chaos of giant creatures. Their fragile membranes surround visitors as much as they do the tempura flower life-forms contained within. The fried flowers' delicious yet funereal smell leaks between vinyl and flesh skins to enfold visitors and stomachs in community metabolism.

Felix Gonzalez-Torres's candy spills from part I form digestive networks activated by glucose metabolism. Yi envelops bodies in metabolizing atmospheres and active olfaction, positioning both visitors and life-size flower forms as stomach contents. Remembering Pipilotti Rist and *Mutaflor*, the loop between mouth and anus expands: giant creatures digest and are digested.

Digestion and metabolism set in train processes that activate a politics against purity.[13] These actions begin with the bits of flower petals, resin, and other detritus that trail behind and are cast off from Yi's stomachs. Working from the ground signals both inductive reasoning and working materially from soil and what falls on the ground. The ground communicates, the bottom oozes, and feces are "little brown messages."[14] A feminist grounded theory approach informed by scatology studies considers actants, practices, and materials in situ to follow leavings and traces across entities, spaces, and disciplines. Following scat leads me down unpredictable trails marked by scientists, theorists, and artists. Their experiments exceed and question everything from human exceptionalism to the political work of the senses to visual culture. Urine and feces show the textures and sensations of digestion's connections with metabolism, reframing excrement as communications from gut microbiomes (see chapter 5). The methodologies and ethics of scatology as a noninvasive system of knowledge production expand giant creaturely senses beyond body boundaries to touch ecosystems, planets, and galaxies.

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# 4

# Adenosine Triphosphate: Metaphors and Materials

The metabolisms of all living things produce and depend on one molecule: ATP. Rigor mortis sets in at death because ATP production has stopped; bodies cannot move without it.[1] Metaphors for ATP help me understand bodies, ecosystems, and worlds. But these same metaphors often resist rather than embrace new knowledge about metabolism and digestion, including shifts from factory to interface and from fuel to environment.[2] This chapter searches for new stories and ideas about how to relate to and embody ATP. How have the ATP molecule and ATP synthase been imagined by artists? How can something so small be seen and heard?

ATP facilitates energy exchange, muscle contraction, intracellular signaling, and RNA/DNA synthesis. ATP makes hearts beat and plants grow. Herman Pontzer explains that "when we use food to make energy, what we're making is ATP." The diagram below introduces ATP's three cycling forms, each with a different number of phosphate groups. All living things depend on these high-energy phosphate bonds. The energy released from this hydrolysis powers the reactions inside all the cells of plants, animals, fungi, and bacteria (everything). ATP and adenosine diphosphate (ADP) cycle back and forth over three thousand times per day in an average person's body.[3]

Like metabolism itself, ATP must be simultaneously understood as very small and very large. It is small, smaller even than the cell, because ATP is just one molecule formed in the mitochondria of cells, but it is large because the bioenergetics of the entire living world depend on this molecule. Without it, life stops. During death, muscles contract and only relax again when they begin to decompose. Living things have options for generating ATP, from fermentation to photosynthesis to aerobic

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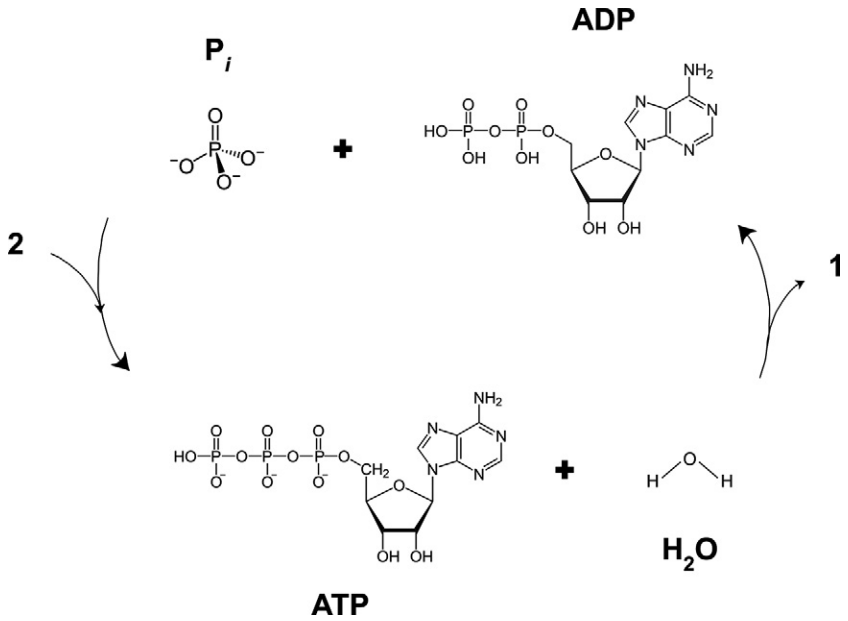


FIGURE 4.1
An adenine base attached to a ribose sugar forms the basis for three related molecules: adenosine triphosphate with three phosphate groups, adenosine diphosphate (ADP) with two, and adenosine monophosphate (AMP) with one phosphate group. ATP releases energy by hydrolyzing one of its three phosphate groups and becoming ADP. Hydrolyzing a second phosphate group produces AMP.

respiration—the method most familiar to mammals.[4] These different ways of generating ATP work together in ecosystems. Ecologists Howard Odum and Charles Hoskin write about the metabolism of water to show how ponds, bays, and lagoons, including their plants, animals, and microbes, become, as mentioned earlier, "giant creatures" carrying "community metabolism, . . . the composite metabolism of the environment."[5] Because entire ecosystems pursue the same bioenergetic end product, ATP and energy flows become key figures for imagining and quantifying community metabolism.

Textbooks and scientific papers tend to refer to ATP as the "currency" of the cell. "Currency" follows nearly every mention of ATP, described as "the energy currency of the cell," "intracellular energy currency," or "the general currency in energy conversions within living organisms."[6]

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Currency has many definitions. An obsolete usage, "the fact or condition of flowing, flow; course," as in "the currency of the stream," would be an elegant description of ATP's constant cycling, movement, and release.[7] "Current," as in electric current, would chart equally sensible paths into ATP's generative capacities and its function as a power source. Pontzer invokes electric current to portray ATP molecules as "microscopic rechargeable batteries, which are 'charged' by adding a phosphate molecule onto a molecule of adenosine diphosphate."[8]

When used to explain the energetic function of ATP, "currency" instead usually describes a medium of exchange, money, as seen on a genetics education website: "Like money can buy any item in a store, this one molecule can power almost any process in a cell."[9] Nature Education echoes this: "[ATP] is often referred to as the energy currency of the cell and can be compared to storing money in a bank. ATP can be used to store energy for future reactions or be withdrawn to pay for reactions when energy is required by the cell."[10] The battery and the bank each illustrate systems of exchange, but the transactional, capitalist implications of the more prevalent bank metaphor allow for what scholar Macarena Gómez-Barris would call an "extractive view" of ATP and so of life itself.[11] ATP makes ecosystems, plants, and animal life metabolically possible. What are the implications of rendering this molecule as a commodity, bought and sold?

How might bodies sense shared life histories with the tiniest molecular materials to emerge after eating? Might proprioception become a method for sensing ATP, and could proprioception extend to become a planetary aesthetic sense that could encourage metabolic perception across bodies?[12] These questions lead me to the elemental materials of ATP's phosphate groups, specifically phosphorus. Circulating in the work of artists Katerina Teaiwa, Latai Taumoepeau, Michael Burton, Jenna Sutela, and Markus Buehler, visual, performance, and "materiomusical" projects find alternatives to "energy currency." Teaiwa and Taumoepeau attend to devastating phosphorus mining outcomes that warn against extractive frameworks by showing how the planetary phosphorus cycle and ATP's energy-rich phosphate bonds connect in a vast planetary metabolism. Used as a fertilizer since the Industrial Revolution, phosphorus has been extracted so extensively and violently that colonial capitalist appetites have impacted entire cultures and islands.

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The isolation and discovery of ATP started with research on muscular contraction. When ATP was first isolated, it took the material form of a salt precipitated from processed muscle tissue. Today, ATP can be purchased commercially, but when biochemists Karl Lohmann and then Cyrus Fiske and Yellagaprada Subbarow first isolated ATP in the 1920s, they started with muscle fiber harvested from animals. The muscle tissue was washed, centrifuged, precipitated, washed again, and so on. Lohmann used rabbit muscle, Fiske and Subbarow used cat muscle, and Justus von Liebig's early experiments with "a hotchpotch of almost anything that could be extracted from meat" (the basis for Liebig's Extract of Meat Company) used cattle slaughtered for their hides.[13] Liebig's career evidences links between ATP and the planetary phosphorus cycle. In addition to his significant role in discovering ATP, he is often referred to as "the father of the fertilizer industry," having identified the importance of nitrogen, phosphorus, and potassium for plant nutrition. In his enthusiastic exploration of extracting compounds from meat, Liebig discovered inosinic acid, an important early isolation from muscle, which Fritz Schlenk describes as "the roots of ATP."[14] (Today, salts of inosinic acid are used as umami flavor enhancers.)[15] Dog and lobster muscles have also contributed to ATP isolation. This menagerie of suffering creatures has happily been made obsolete. Sigma's listing for adenosine 5'-triphosphate disodium salt explains that no animals were harmed in its production.[16]

The earliest scientific papers about ATP did not use currency metaphors to convey its properties, probably because these papers focused on identifying and observing its high-energy phosphate bonds. More poetically and speculatively, I imagine a different pace or attitude prior to postcapitalist modalities. Lohmann's 1929 paper describes the process of isolating ATP from muscle tissue.[17] Fiske and Subbarow's almost simultaneous paper documenting their independent isolation of ATP similarly attends to the material of muscle tissue and the processes undertaken to precipitate, purify, reprecipitate, and test the first isolations of ATP as a salt.[18] This focus on process should not be interpreted as a lack of understanding of "the metabolic importance of 'energy rich bonds'"; biochemist Marcel Florkin finds references to biosynthesis and "the catabolic pathways of lactic acid formation" in the publication archive of Otto Meyerhof's laboratory.[19]

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Biochemist Fritz Lipmann was the first to find that ATP circulates energy within cells. Lipmann used the metaphor of an electric current: "It seems, in fact, that in cell organization the phosphate 'current' plays a similar part as does electrical current in the life of human beings. It is a form of energy utilized for all-round purposes."[20] Lipmann's electric current analogy seems especially appropriate given recent experiments showing that "ATP is a critical signaling molecule that allows cells and tissues throughout the body to communicate with one another. The universal fuel, in effect, serves as a common language as well."[21] ATP writes another "language of the body."[22] Purinergic receptors respond to ATP to allow for extracellular signaling that in turn allows all major life systems to function. ATP steadies the heart rate, affects the liver's rate of bile secretion, and regulates mucus secretion in the respiratory system. ATP's signaling capacities facilitate sensation. While eating, "taste cells, like other epithelial cells, . . . rely on ATP to activate the sensory nerves innervating the taste buds."[23] Without ATP, tongues might never connect with taste buds. Signals and communication allude to currents that flow and travel from one site to another, like electric wires.

If the "ATP bank" facilitates a transactional understanding of ATP and its functions, then following ATP's materials, specifically its elemental phosphate power source, exceeds transactional understandings by linking this tiny molecule to living creatures to the vast planetary phosphorus cycle. A person's body cycles through its weight in ATP every day, so ATP forms the meat space and fleshy material of life.[24] Following materialist traditions in Europe, Petra Lange-Berndt identifies a revolutionary "materialist aesthetic" that resists logics of consumption to assert that "the possibilities of materials should be set free without turning them into commodities."[25] Even though phosphorus mining has created some of the most exploitative extractive zones in the world, the phosphorus cycle, like ATP, forms nourishing relationships between living things and environments that exceed capitalist currency frameworks.

Vocabularies and definitions dictate relations with the fleshy embodied materials that energize the entire living world. Extractive capitalist frameworks bind phosphorus and ATP to ongoing colonial violence. Gómez-Barris explains how "the extractive view sees territories as commodities, rendering land as for the taking, while also devalorizing the

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hidden worlds that form the nexus of human and nonhuman multiplicity."[26] Money metaphors neglect ATP's hidden worlds and still-unfolding additional capacities, including signaling. Factory metabolisms adhere to the extractive view by creating a nutrition science designed to assess "how much energy could be purchased for the same money" when feeding workers.[27] Scholar Hannah Landecker shows how industrial metaphors no longer work for metabolism or food studies, so why do many textbooks and papers still frame ATP in economic terms not mentioned by the biochemists who first isolated it?[28]

Metaphors matter, to both science and art. Paradigm shifts in scientific understandings of metabolism can cause revolutionary and unpredictable effects. Reading the move from vitalism to organicism in developmental biology, scholar Donna Haraway describes a perspective shift that reverberates in current metabolism research, highlighting metaphor's role: "A major reorientation of fundamental metaphor occurs, leading workers in a field to see new problems and to accept radically different sorts of explanations."[29] When metaphors change, possibilities open up. As Haraway writes some decades later, in conversation with anthropologist Marilyn Strathern, "It matters what stories make worlds, what worlds make stories."[30] Money metaphors in biology draw on the same theoretical, technological, and material formations that facilitate mining and industrialization. Aligned with Lange-Berndt's revolutionary materialist aesthetics, ATP deserves to be "set free" from the limiting language of banking and finance. By creating alternatives to capitalist currency metaphors that situate molecules and elemental cycles within sensory encounter and lived experience, artists wrest our cells' energy production from capitalist ideologies and show how ATP balances, regulates, and communicates.

## The Unseeable, the Materiomusical

On paper, ATP appears in all the formats expected from visualizations of molecules, from Lewis dot structures to ball-and-stick models to three-dimensional space-filling models, as well as more elaborate illustrations that show the ATP synthase, a molecular motor that facilitates cycling between adenosine monophosphate (AMP), ADP, and ATP. Live-action

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film and animation allow the ATP synthase to be shown moving through bodies in three dimensions. Both film and paper representations usually show its two rotary motors resembling gears or wheels.

ATP often manifests as what the Amoeba Sisters (science educators Sarina Peterson and Brianna Rapini) call a "starburst or thunderbolt." In their video about ATP, the Amoeba Sisters reflect on their first introduction to and current understanding of ATP with the help of eponymous ovoid, amoeba-animated cartoon characters. The "energy currency" definition features a canned energy drink, and the narrator's voice sounds skeptical and wary of this definition. Seeing ATP in their science textbooks represented by a thunderbolt made Peterson and Rapini think ATP was "like some big blast of energy that helped the cells do things." But they soon learned that ATP was less dramatic than the apocalyptic thunderstorm illustration that accompanies this summary. The Amoeba Sisters calmly show how ATP, in an everyday and not dramatic way, "does things": from active transport (lassoing) to muscle contraction (a muscle cell personal trainer) to signaling (a cell with large anime eyes hosting a radio tower in its cytoplasm).[31]

To visualize the mechanics of the molecular ATP synthase, Benson Koschinski creates a live-action ATP synthase reenactment, rendering the ATP synthase with a combination of digital animation and live action. Hydrogen ions are apples held and released from the mouth of a person slowly rotating on an office swivel chair. Two rows of dancers, digitally collaged to resemble paper dolls, form an oscillating plasma membrane. Although his video takes advantage of computer graphic possibilities that did not exist in 1971, Koschinski's approach recalls Robert Alan Weiss's iconic live-action choreography for *Protein Synthesis: An Epic on the Cellular Level* (1971). A psychedelic soundtrack joins voiceover narration adapted from Lewis Carroll's "Jabberwocky" poem. The short film features an mRNA formation, the dancers adorned with balloons on their heads. Wearing a feathered cape, Initiator Factor One dances across the football field stage to activate the mRNA formation. GTP, costumed in crimson, squirts plumes of water. (The performance depicts the protein synthesis mechanism targeted by mRNA vaccines, which has prompted calls for a COVID-19 era remake.)[32] In the spirit of Weiss's epic, Koschinski uses "body movement . . . to convey how ATP synthase uses the kinetic

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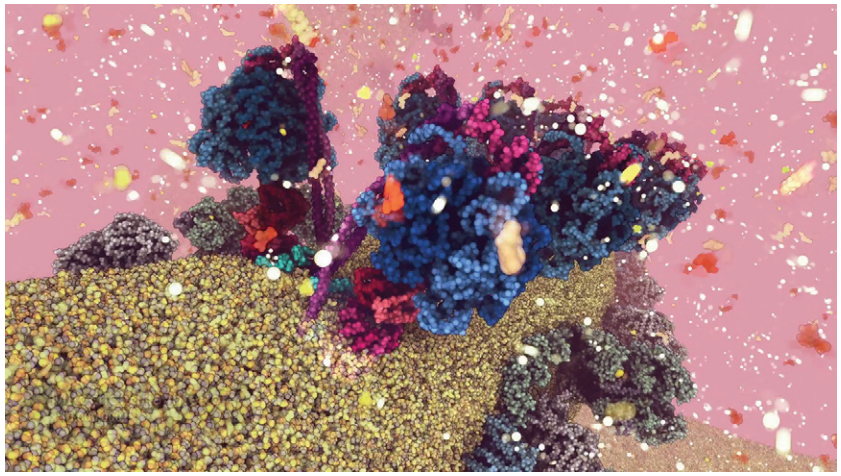

FIGURE 4.2
Drew Berry and Justin Muir, *Synthesis of ATP*, 2018. Animation. Courtesy of Drew Berry and Justin Muir, WEHI.TV.

energy . . . to create chemical potential energy in the form of ATP."[33] If a Lewis dot structure sits at the traditional end of the visualization spectrum, blending live action and digital collage to create an ATP synthase at first appears to be an unconventional approach. But because I owe my muscular movement to ATP, bodies in motion lend embodied immediacy to these science communication experiments. Dance and choreography along with philosopher Barbara Montero's approach to "proprioception as an aesthetic sense" together offer new pathways into ATP's fleshy and embodied materiality.[34]

Animator Drew Berry and programmer Justin Muir's *Synthesis of ATP* (2018) opens with a conventional orange rotating space-filling model of ATP. Accompanied by narration, the video zooms out to a glowing blue cell with yellow ribbons of mitochondria (1,000× magnification), and then zooms in to show mitochondria pulsing and sliding over one another (10,000× magnification). With the question "So where does your ATP come from?" the video zooms into the interior of a mitochondrion (10,000,000× magnification).[35] The animation travels through a "mesoscale landscape" that moves from "the nanometer scale of molecules to the micrometer scale of cells."[36] The framing of the model, the cell, and

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the mitochondria set the flat familiar scenes I might expect when looking at an illustration or through a microscope.

When the ATP synthase enzyme appears, the camera goes through the microscope—through the looking glass—and adopts an immersive point of view. The atmosphere shimmers with flecks of pink ADP and even smaller yellow phosphates churning around like purposeful snowflakes. Their stochastic movement brings specks in and out of focus to place the viewer inside a three-dimensional space. Orange ATP (consistent with the orange space-filling model) emerge in sequence from "molecular motors" that resemble a cross between a simple electric motor with a shaft and rotor and a vibrating stalk of broccoli. The animation highlights each component of the enzyme by isolating the different-colored sections against a darkened background and then returns to full color, dipping below the surface of the mitochondrial membrane to show how crowds of protons generate the positive charge that drives the synthase. At this scale, animators bring perspective, space, and motion to molecules "smaller than the wavelength of light," making direct observation impossible; Berry calls this "unseeable biology."[37]

Decisions about scale, timing, and composition draw on animation's shared histories with cinema and the visual language of film.[38] But ATP can be understood using formats that challenge, undermine, or sidestep narrative cinema. Even if I cannot see ATP with my primate eyes, I can "see" using technologies. Berry emphasizes how his animations are "derived accurately from the science."[39] What exactly does this mean? "Accurately from the science" conjures Haraway's insistence on positioning and locating the "terms" of vision in order to take responsibility for the metaphors and materials that produce partial and contingent objectivities.[40] Unseeable biology depends on prosthetic vision. Molecular artist-researchers David Goodsell, Margaret Franzen, and Tim Herman explain how "mesoscale landscape" models such as Berry's incorporate at least four technical aspects, each drawing from different fields of research. First, electron microscopy informs "cellular ultrastructure." Second, genomic research identifies proteins, nucleic acids, and other ingredients in the landscape's "molecular composition." Third, established knowledge of atomic structure joins cryoelectron microscopy to determine "molecular structure." Finally, research into the thorniest

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visualization problem, "molecular interactions," continues.[41] Movement and vibration must be rendered without recourse to primate vision.[42] Instead, signals are sensed and interpreted by animators by means of their technoscientific "prosthetic vision."[43] Even with this information, "the crowded nature of the cellular environment" can still present challenges when constructing a legible landscape with a compelling narrative.[44] Which molecules should be focused on? Is crowding part of the story? In Berry's ATP synthase animation, the viewer floats within a sea of molecular bits and pieces, some of which combine to form ATP, and others of which stay in the background to form a three-dimensional cellular texture.

Sutela, an artist, collaborated with Buehler, a composer and materials scientist, to create *Wet-on-Wet* (2021), a seven-minute video that layers sound, washes of vivid watercolor pigment, diffraction patterns in water, and thrumming, rotating models of molecules, each centered in a large black circle. The video resembles an inverted view through a microscope: a dark but not empty circle floats on top of flowing brilliant color. Molecules pair with washes of color, rippling water, and a soundtrack comprised of each molecule's "molecular sonification." The sounds were created through a process Buehler developed to interpret high-frequency nanoscale molecular vibrations as audible sounds. Buehler proposes "materiomusical 'Protein Inceptionism' as a possible direction in nano-inspired art."[45] Placing a shallow tray of water on top of a powerful speaker playing the molecular sounds allows for a linked series of visual prostheses to perform a "translation."[46] Sound and molecular structure cometabolize in *Wet-on-Wet*, traveling across material and media, oscillating back and forth.[47]

*Wet-on-Wet* follows seven molecules in an intentional sequence to narrate their cultural and scientific associations with emotions, states, and affects:

> Starting from the sound of the love and bonding hormone oxytocin, the following three sounds come from dopamine, serotonin, and norepinephrine, neurotransmitters which can be dosed for pleasure, appetite, and performance, respectively. What follows is the sound of an ATP carrying energy, then the sound of a growth factor enabling plasticity, and finally the sound of an antibody for protection.[48]

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The wavelets created by molecular sounds produce visual information about the composition of the sounds and the molecules, which Buehler then translates further using video footage of the water processed with a modified Google DeepDream algorithm, searching for patterns. These vibrations and patterns imagine and access molecular structures that communicate unseeable biology by challenging rather than emulating the conventions of narrative cinema and landscape.

Infusing the water with molecular sounds carries everyday folk resonances too. Sutela describes the project as "a sonic toolkit for amplifying the waves of emotive molecules in domestic waters," drawing on "the folk belief in 'dosing' this essential fluid with spiritual potentials."[49] The molecular sonification vibrations infect and infuse the water, which in turn flows through other bodies of water, amplifying the effects. Caroline Jones invents the word "symbiontic" ("symbiosis-as-that-which-is") to depict Sutela's practice, which depends on incorporation, collaboration, and manifestation, noting that "the physical material of more-than-human species are invited to occupy her as 'medium.'"[50] In *Wet-on-Wet*, water becomes a medium, in the sense of visual media, media art, and spiritual medium, and as a body of water that contains the world. Sutela explains how participants can "program" molecular "vibrations into nearby water to be used for drinking, cooking, bathing, painting, fermenting, farming, watering plants, or other activities."[51] These suggested uses pull "unseeable" molecular structures into a seen and slippery world. The metaphors and stories attached to these molecules grant the infused waters cultural agency and material-semiotic force.

Sutela and Buehler detail step-by-step instructions to video viewers that allow audiences to follow along at home and create their own molecularly charged waters. When distributed as a do-it-yourself program, molecular sounds, visions, and vibrations share life history with kits in Fluxus and participatory art. As with artist Beatriz da Costa's *Anti-Cancer Survival Kit* in chapter 3, kits and scripts form communities of practice that generate unexpected new knowledge. When scholar Hannah Higgins writes that Fluxkits promote an "ecological form of experiential knowledge," she refers to the everyday and tactile qualities of Fluxkits along with the cross-modal and "common sensible" aspects of experiential art.[52] This sensory shift becomes the "difference between a project of public understanding

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and a project of public experiment."[53] The molecules are not represented or illustrated so much as they are steeped, like a tea, with washes of color acting as visual cues for symbiontic infusion. Water's utility and ubiquity suggest further actions and affinities.

*Wet-on-Wet* accesses inaudible and invisible molecular forces while staying close to molecular materials and structures. Writing about "energetic objects," scholars Katie Dyer and Lizzie Muller offer a metabolic reading of art objects that are both "extra-sensory" and "resonant." Extrasensory objects "register the impact of energies that we might perhaps not ordinarily notice in the same way we register sound with our ears, or light with our eyes." Resonant objects "not only register energies, but transform or amplify those energies."[54] Dyer and Muller address gravitational forces and potential energy, but their frameworks of sensory expansion and resonance transfer to energetic forces beyond gravity. In *Wet-on-Wet*, states associated with each molecule, from love to appetite to energy to protection, resemble Dyer and Muller's resonant, extrasensory amplifications that can be digested and incorporated. The senses do not stop at or bounce off the surface of *Wet-on-Wet*, as might be expected in a cinematic experience. Instead, water resonates and amplifies to allow the infused molecular structures to be experienced crossmodally, digested and metabolized.

ATP has been depicted as an animated mesoscale landscape, choreographed with dancing and collaged apples and people, and metabolized through folk medicine dosing methods. Could any of these models be regarded as kin to the tissue phantoms that appear alongside food babies in chapter 2? Tissue phantoms are proxies for the flesh needed to practice skills or calibrate machinery. A tissue phantom for ATP would not help in the practical ways that heart, brain, and vein phantoms assist with surgical, infusion, or phlebotomy research and training. But a tissue phantom for ATP could matter conceptually. Tissue phantoms are prosthetic visions, or cultural objects that reveal metaphors and stories about bodies, biology, and medicine. Banking and currency metaphors propose money as a phantom proxy for ATP to understand but also limit ATP's function within cells. What other phantoms are possible?

So far, ATP has conspired with creative works that attempt to sense the materials and structures of metabolism. None of these models, anima-

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tions, and sounds choose banking or currency to illustrate ATP's bioenergetic capacities. To continue this expansive metabolic reading of ATP, I turn to phosphorus, the elemental heart of ATP. The ruinous consequences of extractive approaches to phosphorus mining are apparent all over the world, with some of the most devastating outcomes located in Oceania. But a balanced phosphorus cycle sees this building block of bones, DNA, RNA, and ATP moving through and settling within lifeworlds that recall Odum and Hoskin's giant creature waterways. In and out of balance, phosphorus reveals how metabolic activity connects bodies, ecosystems, waters, and worlds.

## An Eagerness for Bones

Phosphorus makes our bodies possible. Phosphorus wakes us up in the morning. "You can sit up in bed because your body is stiffened by bones made from a calcium-phosphate mineral called apatite," and when you eat breakfast, scholars Jim Elser and Phil Haygarth continue, "your cereal and milk would not have been produced without vital inputs of phosphorus fertilizer."[55] Plants take in phosphorus from the soil through their roots. From there, phosphorus can be stored or moved around the plant, powering every process that requires energy. People glean phosphorus directly from plants, but milk and meat contain more because livestock concentrate phosphorus from grasses that humans cannot digest. Dietary politics and controversies unfold from this chemical truism, spanning paleo diets to vegan diets to government mandates and food pyramids.[56] Phosphorus structures DNA and RNA, cell membranes, and the bones that hold us up. When I die and decompose, I leave behind my phosphorus in my skeleton. Phosphorus moves through plants and bodies quickly; imagine producing your body weight in unseeable ATP each day, with its phosphate groups constantly releasing energy. But phosphorus moves through the planet slowly, accumulating gradually.

Contemplating these different phosphorus temporalities, Teaiwa shows how "phosphorus has a shape-shifting identity as it travels an engineered life course from mined rock, to bagged fertilizer, to crop biomass, to supermarket commodity, to human body, to blooms of toxic algae, to Anthropocenic sediments on the bottom of the sea."[57] Tectonic

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activity moves phosphorus-containing rocks to Earth's surface, and then weathering and erosion distribute phosphorus further, creating sediment in lakes, rivers, and oceans. Overfertilizing leads to imbalances in this cycle, including eutrophication, when nitrogen and phosphorus concentrate in waterways, resulting in restricted oxygen, fish deaths, and algal blooms. As with oil spills, wetlands help by transferring phosphorus from water to plants. The shape-shifting and cyclic attributes of phosphorus at a planetary scale correlate with the molecular scale phosphate groups in ATP. These saturation and scale implications resonate with scholar Myra Hird's characterization of metabolism as a "force" capable of acting across planets, ecosystems, and bodies.[58]

Phosphorus, phosphorous, and phosphate are often used interchangeably, but they are different. Phosphorous, an adjective, describes something containing the element P, phosphorus. Phosphates are compounds of phosphorus—the anions, salts, or esters that "are the actual participants in bodily processes."[59] ATP's three phosphate groups are such "actual participants," and these bonds are ATP's energy source. The diagrams, animations, sounds, and resonances described in the previous section reveal unseeable molecular landscapes and broadcast inaudible molecular sounds, giving sensory access to ATP's structure. The artworks in this section follow the bioenergetic capacities of elemental materials and their ancestral traces.

In 1840, Liebig identified the importance of nitrogen, phosphorus, and potassium for plant nutrition.[60] Although his focus on the phosphorus in inosinic acid did not lead to isolating ATP, the phosphorus in fertilizer would industrialize agriculture. Animal waste contains significant amounts of phosphorus (guano, for example, is bird poop). Before industrial agriculture, phosphorus cycled between proximate bodies and environments when farmers used waste to fertilize their fields. Urban centers, sanitation, and industrial agriculture exploded this exchange between soil, plants, and animal waste, resulting in scholar John Bellamy Foster's reading of the "metabolic rift" in Karl Marx: "To argue that large-scale capitalist agriculture created such a metabolic rift between human beings and the soil was to argue that basic conditions of sustainability had been violated."[61] This rift has widened precipitously since Marx and even since Foster, prompting science writer Julia Rosen to declare that "we broke phosphorus."[62]

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Dire warnings about running out of phosphorus, a finite resource that takes an unfathomable amount of time to accumulate and a split second to extract, echo those about another finite resource, petroleum. Both are experienced metabolically by bodies, technologies, and planets. "Fossil fuels represent the collective metabolisms of uncountable plants and animals in the distant past, toiling away over millions of years," writes Pontzer, "when we burn them, we're releasing the energy stored in these ancient organisms."[63] The same could be said of phosphorus. Instead of working with the phosphorus already present in the immediate environment, fertilizer-hungry agriculture reaches back to coprolites, guano, and ancient skeletons piling up over millennia, strip-mining these residues and bodies in a comparative instant. Teaiwa traces how phosphorus inspires a new "cult of fertility" that depends on "lithospheric, rather than biospheric, phosphorus," creating a world where "supermarkets become an everyday technology of phosphorus distribution."[64] Lithospheric phosphorus conjures the bones and fossils of Pontzer's plants and animals of the distant past. Both petroleum and phosphorus find their way to gas tanks and supermarket shelves, only to be burned as fuel or flushed down the toilet and out to sea.

Teaiwa's *Project Banaba* (2017–) gathers artifacts, footage, and artworks in a site-responsive installation to remember Banaba (Ocean Island), which was destroyed when it was mined for phosphate primarily used to fertilize crops across Australia and Aotearoa / New Zealand. Banabans were forced off their island during World War II and relocated to Fiji, where Teaiwa, who is of Banaban, I-Kiribati, and African American heritage, was born and raised. The installation mixes archival research, family history, and new textile and multimedia works. Sturdy burlap sacks, the same material used to package bags of fertilizer, scaffold a timeline history of Banaba. In contrast, photographs of Banabans on Banaba appear on a gauzy, nearly translucent fabric. Teaiwa intended the photos of Banaban ancestors to appear "ghostlike," wanting visitors "to be as haunted by this as our communities are."[65] The installation shares its archive with Teaiwa's book, *Consuming Ocean Island: Stories of People and Phosphate from Banaba*, offering immersive and time-based access to her research on how Banaban ontologies change, resist, reshape, and challenge narratives of extraction and dispossession. Teaiwa predicts the translucent layers and

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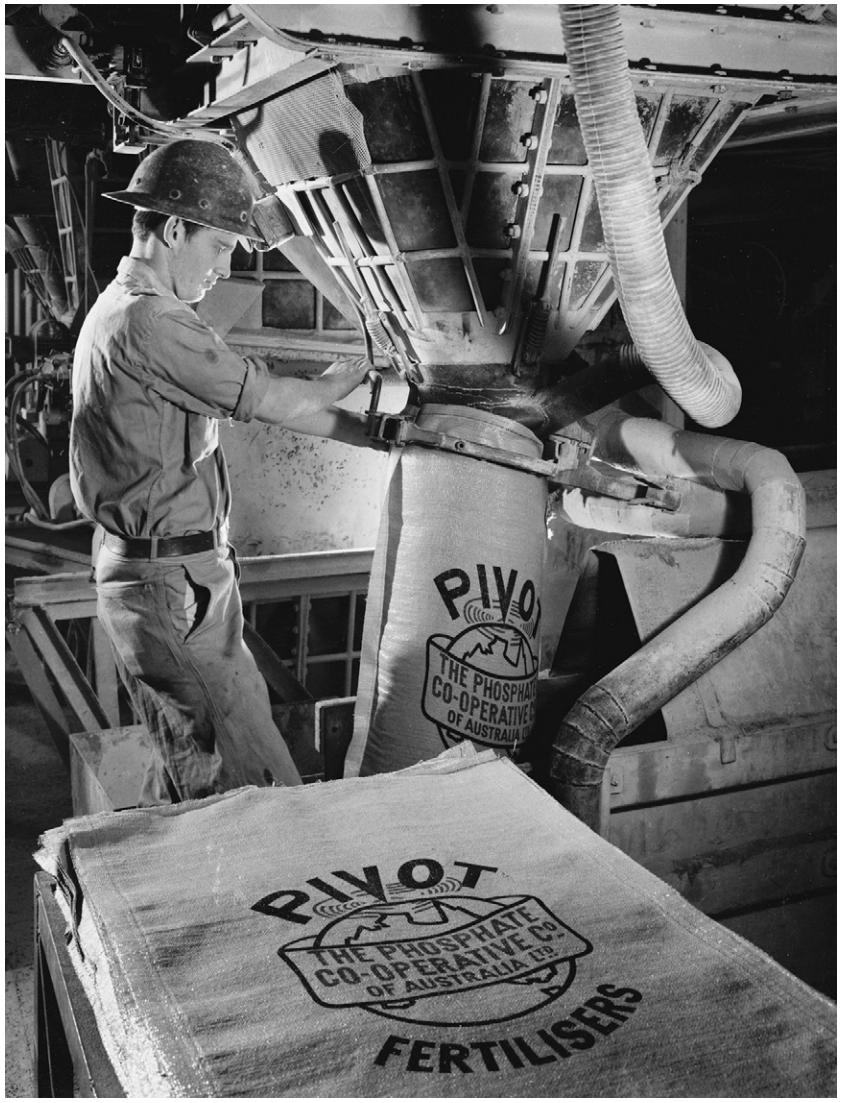


FIGURE 4.3
Wolfgang Sievers, Man filling bags with fertilizer at Geelong phosphate plant, Victoria, 1969. Photograph, 10 × 7.5 in. Wolfgang Sievers photographic archive, National Library of Australia, nla.obj-161511110.

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patinas of the *Project Banaba* installation by collaging archival images, chemistry flowcharts, tables, and fiction excerpts, including Aldous Huxley's vision of phosphate recovery during cremation in his novel *Brave New World*.[66] Remix and collage become research-creation methods that connect written and installation modes, producing temporary constellations in a "sea of phosphate" composed of moving and flowing images, words, and artifacts.

Banabans were forcibly relocated in multiple senses: both people and land moved. Teaiwa explains that "*Te aba*, *kainga*, and *te rii* in Gilbertese (the Kiribati language) refer, respectively, to the land and the people, home or hamlet, and bones," so "te aba is thus an integrated epistemological and ontological complex linking people in deep corporeal and psychic ways to each other, to their ancestors, to their history, and to their physical environment."[67] *Te aba* does not distinguish between Banaba's phosphorus-rich guano, the bones of Banaban ancestors, and the coral island supporting what used to be a fertile landscape before the British Phosphate Commission stripped the entire landmass of its topsoil, vegetation, and people. Mining stopped in 1979, but with no bioremediation or repair, returning to the island would be "like going to the moon," according to Ted Otiong, a Banaban on Rabi Island in Fiji.[68]

Decades before the British Phosphate Commission began mining Banaba, Liebig wrote, "Great Britain is like a ghoul, searching the continents. Already in her eagerness for bones, she has turned up the battlefields of Leipzig, of Waterloo, and of the Crimea; already from the catacombs of Sicily she has carried away the skeletons of many successive generations."[69] The ghoul traveled beyond Europe "in her eagerness for bones," mining not only Banaba but also Christmas Island and Nauru, which today house Australia's infamous refugee detention centers. Teaiwa reminds me that mining and refugee detention are connected because of "the imperial unravelling of fundamental relationships between islanders and their landscapes, commoditizing such places so that the break in hundreds of years of kinship with the land turns into a series of ruptures between people, each other and others."[70] The ruptures that characterize displaced populations and mining histories on these islands set the stage for those that characterize the refugee detention industry, a "physically dehumanizing . . . carceral regime."[71] Refugee bodies enter islands

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already defined as extractive zones, or more precisely, extracted zones, as there is little left to take away. Scholar Julia Morris makes a powerful claim of equivalence, arguing that "refugee processing . . . has come to replace phosphate in Nauru as a monocrop industry, raising anew questions of consequential impacts and socioeconomic dependency."[72] The detention centers are a bleak counterpoint to the achievements of First Nations people resisting mining in extractive zones. With the islands all but destroyed by mining, the resistance and suffering of refugees haunt the gauzy outlines that remain after over a century of phosphorus extraction. Teaiwa's metabolic reading positions contemporary *te aba* within a translucent permeable membrane of First Nations' struggles against extraction.

Tongan Australian artist Latai Taumoepeau's durational performance *Ocean Island, Mine!* (2015) sees Taumoepeau steadily laboring to move over a thousand pounds of ice about twenty paces away from where she started. As she shovels the ice, it melts and spills; a thin layer of errant cubes sparkles against the pavement between the two mounds. Her white jumpsuit and shovel echo the white ice; sometimes carried and sometimes dragged, the shovel rattles and scrapes the asphalt between the two piles of ice. Taumoepeau links shoveling to traditional movement; shoveling "is the dance of today." As a "diasporic Tongan 'self-appointed' punake (master composer)," Taumoepeau anchors her practice in tradition. Taumoepeau clarifies that "my audience is white people, and I make work about white people *around* brown people," a tactic designed to, in scholar Talei Mangioni's words, "confront Australian apathy" about the climate crisis in the face of the country's coal economy and lack of climate policy.[73] In *Ocean Island, Mine!,* reflective white ice on asphalt simultaneously references mined phosphate, rising sea levels, and melting glaciers.[74] *Project Banaba*, too, urgently confronts climate crisis. Teaiwa's archival materials function similarly to Taumoepeau's shovel. Both artists remix and recontextualize tradition and history to open new pathways. Archives and actions metabolize elements, energy, and dispossession. Banabans are among the first climate refugees, their land and bones stolen to create phosphate fertilizers that contribute to anthropogenic climate change. Faced with undertaking adaptive measures to respond to the climate crisis, Kiribati's size and spread mean that "it is extremely

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unlikely that sufficient resources could ever be mobilised to build climate resilience for all of the islands."[75] Mining perversely accelerated and amplified sea level rise, lowering Banaba more than sixty-five feet closer to the waterline.

Chemists and astrobiologists have been investigating the possibility that the first usable phosphorus arrived on Earth in meteorites. This theory aligns with Banaban cosmology and origin stories. As told by Teaiwa, "Banaba was always rock, so even the sky was rock, and the land falls from the sky into the ocean and becomes Banaba, . . . the navel of the world."[76] Rock falling from the sky to create life supports findings that "iron meteorites provided abundant reduced P to the early Earth and therefore should be considered in studies of the origin of life."[77] In collaboration with chemist and astrobiologist Terence Kee, who also researches meteoritic phosphorus, artist Michael Burton's *Astronomical Bodies* (2010) "proposes the recovery of phosphate from our bodies in urine to create meteorites to distribute biological chemicals to hospitable celestial bodies."[78] Bulbous trousers and aprons with bladder appendages capture urine to be processed to recover phosphorus. Men model Burton's garments, which look as if they would be much easier to operate while standing. Given historic gender imbalances in the mining industry, placing the burden of collecting urine and recycling phosphorus on men seems appropriate. After processing the urine, phosphorus crystallizes on small round structures that resemble loose balls of yarn. The project's final phase remains speculative, anticipating that these man-made pee meteorites will be launched into outer space, seeding life-giving phosphorus across the galaxy.

Burton reenacts the process alchemist Henning Brand followed in 1669 when phosphorus was first isolated from "more than 5000 liters of . . . urine collected from dozens of beer-drinking German soldiers and from horses."[79] A process of boiling and distilling eventually yielded the first chemical element. Burton's garments outfit a new army of phosphorus recyclers. Designer and philosopher Benedict Singleton articulates how Burton reimagines space exploration by "rejecting the naval metaphors that dominated the first Cold War steps upwards ('sailing the stars') in favour of contamination as the means to travel through huge distances and time spans."[80] *Astronomical Bodies* shifts "first contact" tropes from

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in-person infection (recalling the long history of colonizer-caused pandemics) to remote life-giving chemical intervention. If *Astronomical Bodies* figures the galaxy as a garden instead of a mine, the meteorites fertilize future Earths. The recycled phosphorus meteorites cast a stream of urine into outer space to infect other planets with the phosphate and phosphide compounds that made early life on Earth possible. But naval and pandemic contamination have always been linked. A shift from sailing ships to bacterial infection does not necessarily undermine or even complicate the colonial project.

Although Burton's "P-selves" help Earth's phosphorus cycle by diverting waste from the water supply, the meteorites do not return the phosphorus to Earth to replenish what has been lost. Scholar Monika Bakke situates *Astronomical Bodies* as a "reconsideration of the human metabolic relationship with minerals" that "translat[es] the human body into a flow of minerals"—a flow that can be redirected through alternate pathways to realign global phosphorus cycles.[81] Elser and Haygarth emphasize an urgent need to "recycle waste phosphorus to close the phosphorus cycle."[82] *Astronomical Bodies* builds on the arts' capacity to spatialize and imagine alternate pathways, mapping a body-flow of minerals that extends beyond Earth's atmosphere. Burton's project suggests linked interplanetary metabolisms. Community metabolism becomes galaxy metabolism. Bakke stresses the project's orientation toward the speculative: "The artist turns something as banal as urination into a life-originating cosmic act."[83] This extraterrestrial act happens on an unknown future world.

A form of interplanetary engineering akin to geoengineering on Earth, *Astronomical Bodies* accelerates the processes that gave Earth its phosphorus. This acceleration sits in ambivalent tension with Teaiwa and Taumoepeau's perspectives from the Oceanian diaspora. Recycling phosphorus from urine would seem to resist extraction. As a form of antimining, *Astronomical Bodies* has the potential to contribute to interplanetary flourishing. Yet the masculinist bodily experiences that animate Burton's project, from the armies of men peeing in their aprons to white P-balls flung into the void and "seeding life on other planets," sidestep the urgent questions about displacement, climate politics, and colonial violence on Earth. These concerns give Teaiwa and Taumoepeau's phosphorus projects political urgency and relevance.

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While Burton adopts a view from above, catapulting Earth-bound elements into space, Teaiwa and Taumoepeau remix traditional forms, diaspora, and displacement to inhabit what Gómez-Barris calls "submerged and emergent perspectives within the extractive zone." These standpoints nourish knowledge systems and ways of being that have never been fully colonized or enfolded into extractive capitalism: "forms of life that cannot be easily reduced, divided, or representationally conquered or evacuated."[84] What if all forms of life were such forms of life? Plant and animal metabolisms have not been entirely conquered by capitalism. Pockets of elemental resistance animate the cells and muscle movements of even the most offensive "ecopaths."[85]

If plants, animals, and bacteria managed phosphorus in the unsustainable way fertilizer industries manage phosphorus, there would be no life on Earth; the entire planet would resemble Banaba's moonscape. Remixing global phosphorus flows with phosphate reactions in cells interrupts extractive capitalism. A balanced phosphorus cycle narrows the metabolic rift and diminishes the algal blooms that follow phosphorus runoff from agriculture. A circular phosphorus economy resembling ATP's cycling phosphate groups would dismantle the ghoulish colonial search for phosphorus that has devastated Banaba and other extractive zones.

By keeping high-energy molecular phosphate bonds and phosphate fertilizer in the same view, bodies and worlds are in materiometabolic relation. If "the elements are mattered as extractable commodities, alienable bits of life and death and nonlife, and as energies that fuel global economies," Dimitris Papadopoulos, María Puig de la Bellacasa, and Natasha Myers ask "what . . . are our obligations and responsibilities in mediating the distribution and redistribution of the elements?"[86] ATP flows through cells and cultures to suggest approaches to these obligations and responsibilities. Mammals create and recycle their body weight in ATP every day, do it again the next day, and have yet to collectively break or undermine the function of high-energy phosphate bonds in the cell. Yet phosphate fertilizers have impacted cultures, landmasses, bodies of water, and lifeworlds, as with Banaba, Nauru, and all alga-infested waterways. Giant creatures struggle to breathe. ATP can be understood as a model for a planetary phosphorus cycle that does not break.

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Following material metabolic links between cells and planets (and meteorites) allows for tangible access to processes that are ordinarily too small or too large to be perceived by primate senses. If I understand the planetary phosphorus cycle to be linked with the constant cycle of ATP in my own body, my fleshy phosphate bonds fall into urgent sensory relation with community, planetary, and even interplanetary metabolisms. The projects in this chapter sense molecular processes that are too tiny to be experienced directly. At the same time, ATP and phosphate bonds create movement and signals that constitute and facilitate direct experience. Muscle movement powers dance visualizations of ATP. Vibration and folk dosing access "sound using senses other than our ears."[87] Shoveling, archiving, and remixing shape the labor required to share life history with extractive zones. A metabolic reading of these crucial but tiny circuits flowing through my body sediments elemental obligations. Pathways for sensing and acting within the global phosphorus cycle open.

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# 5

# Poop Circus

By cultivating intimacy with and curiosity about excretion, a new genre of poop process art repositions or outright rejects mainstream interpretations of waste in society and abjection in the arts.[1] This chapter offers metabolic readings of feminist, queer, bioart, installation, and performance projects that use poop's materiality to reposition metabolic "waste." The unruly return of digested and excreted matter facilitates new understandings of multiscalar giant creatures, including ecosystems, sanitation systems, planetary health, and linked microbiomes.

All plants, bacteria, and animals excrete surplus or toxic compounds. In mammals, the excretory system's main organs are the kidneys, which pull water and waste from the blood to produce urine. The digestive system forms feces from chemical and physical actions in the mouth, stomach, and intestines. The skin excretes excess water and salt through sweat. The liver supports both digestion and excretion to break down toxins and help process fat. Animal exhalations are excretions, giving lungs and breath an often-overlooked metabolic capacity. Lungs excrete more than carbon dioxide; breath contains surprising ingredients, including fat and DNA.[2] Shitting and pissing complement breathing and sweating; all "body products" are signs of metabolic life.[3] How do artists complicate everyday interactions with waste and the conundrums of abjection to conceive of bodily excretions as communicative?

To position conventional poop theory, I start with a potted history of representational and conceptual poop art. Artist Hannah Jickling and Reed Reed's *Multiple Elementary* (2012) and Wim Delvoye's *Cloaca* series complicate this pile of canonical shit and piss artworks by transforming poop image into body process. Fecal matter might be experienced as

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a bond or link between people and shared microbial resources, as with Kathy High and Anna Dumitriu's work on fecal microbiota transplants (FMT). Mary Maggic's *Housewives Making Drugs* (2017) and Julian Abraham's *Diabethanol* (2018) spin out this excretory dialogue to consider global environmental and health concerns. Cassils's *$HT Coin* (2021) incorporates detailed historical research on the diets of white male artists to claim shit as a responsive, unique, and personality-driven product while "bring[ing] gender and racial inequality into focus within the greater arts and crypto community."[4]

The projects in this chapter reveal the undercurrents and tides that connect bodies of water, surfacing flows and movements that operate below the surface of conscious awareness. Feces and urine flow across bodies of water around the world, contributing to scholar Astrida Neimanis's gestational "gifting of one's own materiality."[5] Sometimes this gift economy moves from one mammalian body to another, as with FMT or estrogen derived from human or horse urine. At other times, bodies of water contribute to planetary waters. Decomposed matter lingers in ecological systems, for longer than might be expected. Dinosaurs are bodies of water too, and petroleum extraction generates large volumes of "produced water." Metabolic readings of body waste process art transmit situated, frequently hidden or sunken lived experiences of digestion—the communicative and responsive capacities of guts, colons, and microbiota.

The last hundred years have yielded a substantial load of representational and conceptual poop art. Most of this work reinforces the idea that excretions are waste and must be disposed of or contained. Bombastic, dramatic, and oversize poop art depends on sanitation systems to be understood. Without a daily practice of flushing away my own shit in a porcelain toilet, I might struggle to find humor or transgression in confrontations with actual or represented poop in galleries and museums.[6]

Piero Manzoni's iconic *Artist's Shit* (1961) gathers an edition of ninety multiples in small tin cans (about the size of a small can of tuna). Each tin purportedly contains "Artist's Shit / Contents 30 gr net / Freshly preserved."[7] While this work often receives attention in poop art roundups, the tinned shit was not a one-hit wonder.[8] *Artist's Shit* finds a body process context among Manzoni's other works from this era, including his breath captured in a balloon (exhalations being as excretory as feces)

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and limited editions of his thumbprint. *Living Sculpture* (1961) placed his signature on the live bodies of models.[9] Manzoni's practice became an "affirmation of the body itself as a valid art material" within an ethos of showing "the process of art," and as RoseLee Goldberg continues, his dedication to body process sought "to prevent . . . art from becoming relics in galleries and museums." Of course, the cans that comprise *Artist's Shit* became precisely relics—a becoming heightened by the artist's death only two years after producing them. Manzoni died in his studio from cirrhosis of the liver at thirty years old.[10]

Responding to its worthlessness under capitalism, and looking back to early and premodern fecal values, artists compare poop with, coat poop in, or measure poop against gold. Manzoni's cans were meant to be sold by weight at the price of gold. Subsequently, the cans have sold for much more, with can #69 selling for €275,000 in 2016 (at its peak in 2016, gold was valued at just under €40 per gram).[11] Terence Koh (asianpunkboy) sold his *Gold Plated Poop* (2007) to collectors, while Tobias Wong and Ken Courtney (Just Another Rich Kid) continue to sell their limited edition *Indulgences: Gold Pills* (2005) for $425 each.[12] The pills promise a golden, glittery poo.

Turning toward poop's social value, Sulabh composting toilets have created social change among India's manual waste scavengers, often Dalit women. Santiago Sierra's minimalist *21 Anthropometric Modules Made from Human Faeces by the People of Sulabh International, India* (2007) worked with Sulabh to package a large volume of humanure in large crates. The installation displays monoliths that take the shape of the crates in which the humanure was shipped; "the faecal matter . . . was left to dry for three years, during which time the material . . . degraded back to an earth-like substance." This was then "mixed with Fevicol, an agglutinative plastic."[13] Sierra's shit monoliths present a material paradox: synthetic resin transforms the Sulabh slabs from fertile soil into plastic waste. Journalist Rose George visited Sulabh's headquarters when the crates were being packed. Her detailed history of the Sulabh social movement and interviews with Sulabh founder Bindeshwar Pathak do a better job than Sierra's extractive and resin-laden sculptures at conveying Sulabh's social impact.[14] In India, "Sulabh" has become a synonym for toilet, like Hoover for vacuum or Kleenex for tissue. Sulabh's regenerative composting methods bring

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waste back into a circular economy.[15] When Sierra infuses compost with resin in *21 Anthropometric Modules*, this added plastic widens site-specific metabolic rifts and the Great Pacific Garbage Patch as well as the cultural and historical rifts that separate the material production of the humanure in India from its exhibition site in the United Kingdom.[16]

Santiago's minimalist modules are serious and weighty, making them exceptions to the general rule that art about poop should capitalize on poop's humor and entertainment value. Art collective Gelatin presented *Vorm—Fellows—Attitude* (2018) at the Museum Boijmans Van Beuningen in Rotterdam, Netherlands. *Vorm—Fellows—Attitude* recalls "theorist of gold and shit" John Miller's series of poop sculptures in the 1980s, expanding Miller's already bigger-than-life-size piles to a monumental scale.[17] While wandering among the monumental sculptures of poop piles placed on carpets, visitors are encouraged to "ride the brown slug to Walhalla" and can try on knitted "naked suits" adorned with genitalia.[18] Paul McCarthy's *Complex Pile* (2008) constructs a huge, gently undulating, and funny inflatable pile of poop. Although often interpreted as a dog turd, *Complex Pile* could be any kind of turd. The inflatable became unmoored while installed on the grounds of the Paul Klee Center in Berne, Switzerland. The size of a house, *Complex Pile* brought down a power line and broke a window when it crashed into a children's home.[19] Image-driven poop art gets out of hand, implying that sanitation and flushing away create a monstrous underworld of giant farcical turds waiting to escape and wreak havoc.

Urine has its own canonical work: Marcel Duchamp's ready-made sculpture *Fountain* (1917). Duchamp recontextualized a urinal by installing it, unplumbed, in a gallery space. *Fountain* has been peed on in museums and galleries by several visitors, including Brian Eno (1993), Pierre Pinoncelli (also 1993), and Björn Kjelltoft (1999).[20] To create the abstract patterns, arcs, and splashes on copper that comprise his *Oxidations* (1977) series, Andy Warhol enlisted the help of, in biographer Bob Colacello's words, "ghost pisser" friends.[21] Referencing ghostwriters, ghost pissers make the work in Warhol's factory setting. Andres Serrano's *Immersion (Piss Christ)* (1987) suggests the process of submerging a plastic crucifix in a container of pee and photographing it. Reading the wall text matters; "a deep golden, rosy glow that is both ominous and glorious" becomes,

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for Lucy Lippard, "a sign of rebellion or an object of disgust."[22] *Piss Christ* was never a "wet" work; the photograph, on paper, and the title and materials list are the only pathway to understanding the source of its luminous amber atmosphere. With national media attention and controversy amplifying its discursive aspects, *Piss Christ* is arguably a text work. Making Warhol's, Serrano's, or even Duchamp's work (depending where the urinal came from) would have been a smelly, visceral experience. Gallery and museum exhibition spaces sterilize the sensory encounters with actual urine and metabolic processes that animate the production of these iconic piss projects. Eno, Pinoncelli, and Kjelltoft try to rectify this by contributing their body fluids to exhibition spaces while peeing on *Fountain*, but urine's sensory presence dries out, fades away, or is cleaned up by sanitation workers whose names do not appear in documentations of these performance actions. Pee could be paint, light, or infrastructure.

Excretions thread through practices that could not be easily contained by representational or conceptual poop art. Mary Kelly includes soiled diapers in her *Post-Partum Document* (1973–1979), but fecal traces appear in Kelly's complex six-part installation as just one component of a complex body process collaboration with her son.[23] Karen Finley smears yams and chocolate on her body in her performances, including *We Keep Our Victims Ready* (1990) and *I'm an Ass Man* (1985), but as with Kelly, Finley does not stop at feces. Lisa Levy's performance *The Artist Is Humbly Present* (2016) sees Levy critically respond to Marina Abramović's *The Artist Is Present* (2010) by sitting naked on a toilet, with another toilet placed opposite for a visitor. The setup mirrors Abramović's two chairs installed at the Museum of Modern Art in New York City. Levy's toilets, like *Fountain*, were unplumbed, emphasizing the symbolic vulnerability of the sitter's posture rather than the toilets' practical function. Kelly, Finley, and Levy's projects incorporate excremental materials and postures, but their concerns are broader, and their materials and content are more expansive.

Although his team of ghost pissers represent networks of friendship in Warhol's oxidation series and social justice activism nominally supports Sierra's crates of resinous Sulabh waste, these works neglect the communicative aliveness of metabolic excretions. Kelly's *Post-Partum Document* does track the relationship between diet and fecal output. But all of these

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works, even *Post-Partum Document*, remove poop from circulation, rendering the body's daily outputs rejected, dead, and wasted.

How did valuable body solids and fluids shift from resource to waste? Sewer infrastructures create new ways of thinking and speaking. Scholar Dominique Laporte's *History of Shit* links sanitation to the formation of the modern individual. Laporte reads ancient Rome's cloaca maxima sewer system as "the signifier of civilization par excellence," and follows other sewers, "perfect urinals," and "exquisite latrines" across the colonial world.[24] The sanitation project marks an economic as well as a cultural shift. Scholar Daniel Max Gerling writes, "Before the mid-to-late 1800s, excrement was a commodity, a valuable fertilizer collected by scavengers and bought by farmers," only becoming "waste" as "the logic of sanitation and civilization" introduces new forms of subjectivity.[25] These are the embodied forms of knowing that I bring into museums and galleries when looking at representational and conceptual poop art. My living environment allows me to discard my poop—a situation Laporte names the "*domestication* of waste."[26] These porcelain surroundings produce Gerling's "fantasy of the excrementless body."[27] Living inside this fantasy permits me to laugh at spectacular, spectral, and outsize turds inhabiting galleries and museums.

The sanitation project and contemporary urban waste disposal systems, according to scholar Annemarie Mol, "give human exceptionalism a material shape." Mol's eating bodies have appeared in most of these chapters. Domesticated sanitary systems, imaginary bodies without waste, and representational and conceptual poop art each assume that bodies move through worlds unfettered by waste. Mol reverse cycles bodies and infrastructures to flow in the other direction: worlds move through eating bodies, digesting bodies, and metabolizing bodies. Mol's metabolic reading raises the theoretical stakes of Sierra's resin compost, McCarthy's inflatable dog shit, and Koh's gold-plated turds. These projects dramatically withhold waste from "metabolic loops and spirals" because they share methods, materials, and production values with human exceptionalism and environmental collapse.[28]

No matter how much I flush and clean my toilet bowl and my body, when aligned with human exceptionalism, shit will always terrify. Gerling's finding "that 'evil' was the most common euphemism (or perhaps

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dysphemism) for shit" in the nineteenth century recalls Laporte's observation that shit and death threaten as they converge: "The Christian West has long responded with equal terror to the smell of shit and of corpses."[29] This terror can be analyzed with scholar Julia Kristeva's theories of abjection. Corpses and shit threaten to and eventually do "end up engulfing us," because "refuse and corpses show me what I permanently thrust aside in order to live." Kristeva separates the "clean and proper" body from "the mixtures, alterations, and decay that run through it," which "points to the infinitude of the body proper and gives rise to abjection." The language of "running through" resembles the sanitation project itself, with its pipes and flushes concealing an underworld and a collective unconscious. Food becomes waste as it "runs through" and out of bodies. Kristeva's world at first appears to reduce to something consumed and ejected, something that "goes out of the body, out of its pores and openings."[30]

In the arts, this is where many approaches to and uses of the word "abjection" stop, locating and staying close to disgust and abhorrence. In the catalog for *Abject Art: Repulsion and Desire in American Art*, a 1993 exhibition at the Whitney that continues to influence the meaning of abjection in the arts, curator Simon Taylor describes the abject intrusion: "Scatological assemblages, bodily fragments, and base materials—dirt, grunge, and the traces of sexual difference—have defiled the white cube of the gallery space" with an "insurgent materialism."[31] In this framing, the abject threatens and contaminates, and so cannot account for a productive communicative entanglement of body and waste. Artworks become waste, running through the clean and proper white passages of the exhibition space.

In a metabolic reading of poop art, abjection exceeds defilement and any neat characterization of the body as plumbing or shit as corpse. Generations of feminists have worked through Kristeva's theory of abjection, questioning how abject relations activate mothering, plastic surgery, and more.[32] While abject may have become a sophisticated synonym for disgust in the arts, feminist theory has pushed for troubling and difficult interpretations that are more attuned to Kristeva's assertion that "abjection is above all ambiguity."[33] Scholar Elizabeth Grosz figures this ambiguous persistence of the abject, which "can never be fully obliterated but

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hovers at the borders of our existence, threatening the apparently settled unity of the subject with disruption and possible dissolution."[34] Grosz's hovering specter offers dialogue, disruption, and dissolution, and suggests the change or transformation that could unfold from recognizing the communicative capacities of the abject. Mol's world moves through the body while Kristeva's body and world hover at one another's edges, threatening and unsettling but not quite in direct communication.

For an increasing number of artists and pooping subjects, feces can no longer be flushed away as the "radically separate, loathsome. Not me. Not that."[35] For many, feces cannot even be seen as waste. Body boundaries are changing. Evolving understandings of the gut microbiome as a multispecies assemblage have inspired feminist, queer, bioart, and performance artists to regard poo differently. Metabolic waste begins to be appreciated as communication from the microbiota at work in the digestive tract instead of a disgusting and even terrifying constitutive outside. Laporte's corpse analogies no longer hold. Poop lives. More than half of our fecal matter consists of viable bacteria transitioning away from the bowel.[36] A study of stool samples collected in an anaerobic chamber found that around half the bacteria in the stool sample were alive, with intact membranes. Even outside the anaerobic environment, fecal bacteria thrive. A study of public surfaces, from restaurant menus to copier buttons, found that fecal coliform bacteria survive almost everywhere.[37] Microbiomes create maps of cities and populations; the Underworlds upstream urban sewage sampling project "showed that each neighborhood has a unique and reproducible microbiome signature."[38]

Observing and analyzing poo contains its own science: scatology. Writing about identifying and studying animal scat, science writer Heather Catchpole describes feces as "little brown messages."[39] For the scatologist in the field, excrement yields information about population size, diets, and ecosystem dynamics—all freely available without interfering with creatures. Fossilized poos, or coprolites, allow for analysis across millennia. Scatology's gentle, noninvasive methods give the communicative pooper similar insights into the cultures of microbial communities. Artist and educator Susan Livingston frames feces as a glimpse of internal mysteries: "When it leaves our bodies, it carries with it an impression of our insides, a cast of our intestines, and a map to part of ourselves we

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will never see."[40] One of few resources available to amateur poo investigators, the Bristol stool scale focuses on appearance rather than microbiome messages. The short book *What's Your Poo Telling You?* elaborates on the Bristol scale, emphasizing that poo has something to say. Dwelling on texture and appearance ("Number Three," "Soft Serve," and "Pebble Poo") as well as dietary consequences ("Ring of Fire," "Floaters vs. Sinkers," and "Rotten Poo"), the book makes a serious argument for fecal dialogue without losing sight of poo's humor.[41]

Poos are little brown messages from microbiota. Changing poos communicate changing bacterial populations. Science writer Ed Yong nuances the role of bacteria in the gut when he explains that bacteria "work *via their hosts*. They are more management than labor."[42] When the microbiome changes, management changes. This analogy casts microbes as more subject than object, more agential than even "vibrant matter" or "lively objects."[43] Problems in the gut, such as *Clostridium difficile* or Crohn's disease, can be interpreted as imbalances in the microbial population—bad management. To perceive changes in bacteria populations and respond to them, pooping subjects attune to body process. Instead of seeing poop and responding with "not me, not that," reactions must become dialogues. Such dialogues contribute to circular economies and new definitions of waste, linking food waste, excrement, and pollution. More than raw material, waste becomes an active participant in understanding self and world.

## Poop Classroom, Poop Dialogue

Livingston anchors her rumination on poo, disgust, and excess in the process of teaching coil building with clay to a fifth-grade class: "Coils, no matter what I call them, look like poop. The coils are long, fat, cylinders of sticky brown mud."[44] Clay isn't the only material to bring laughter into the poop classroom. Jickling and Reed's *Multiple Elementary* was developed during an artist residency located in elementary school classrooms in Toronto. Responding to a unit in the curriculum, "Canada and Its Trading Partners," the artists and their student and teacher collaborators produced snowball sales, *Abject Awards* made from recycled floral arrangements, and the project I focus on here, *Ask Me Chocolates*. A chocolate

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design, manufacturing, and trade cycle emerged from research-creation activities, field trips, artist talks, and presentations on artist multiples and the global chocolate economy. Each student designed a mold from food-safe silicone and cast an edition of chocolate multiples that included packaging, a title, and a concept statement. A book reflecting on and titled *Multiple Elementary* presents images of the chocolates on its wraparound book jacket. Recalling the key printed on assorted chocolate boxes, the image links to the title and concept statement on the reverse. Chocolates include "Cocoa Bean," "Trash," "Snowball," and "Venus of Willendorf Williams," and were traded by their makers for kid economy items such as "songs, services, and objects such as books, a light saber, a can of tuna, an autographed baseball, a serenade, dancing, and a headstand."[45]

After a field trip to craft chocolate manufacturer ChocoSol in Toronto, students witnessed the Molino machine transforming cacao nibs, which ooze from the machine "as plops and dribbles of liquidy brown chocolate paste" and have "some clear associations."[46] Jickling and Reed suggested that the students' multiples be made out of responsibly sourced and manufactured dark chocolate from ChocoSol, but the students rejected the samples they tasted, declaring that "bitter chocolate is for adults!"[47] Dark chocolate would be useless in their kid economy.

Like Livingston, Jickling and Reed introduce Delvoye's *Cloaca* series to their students. Even if dark chocolate was not their preference, the Molino machine made a strong impression and prompted Jickling and Reed to show students the room-size mechanical assemblages of repurposed appliances, vats, and tubes. Each *Cloaca* simulates chemical and physical digestion across changing components, culminating in the extrusion of turds onto a revolving tray. *Cloaca Turbo* (2003) links a series of stainless steel appliances with round windows recalling washing machines, while *Personal Cloaca* (2006) adapts an actual washing machine for externalized digestion at home. *Cloaca No. 5* (2009) uses a ladder to feed a gravity-propelled stack of machinery, with a poster emulating Chanel hanging on the wall. The *Cloacas* inspired *Multiple Elementary* student Aski to make an "intestine" chocolate. Aski explains that "our intestine is important because if you didn't have a [*sic*] intestine the digested thing wouldn't properly come out."[48]

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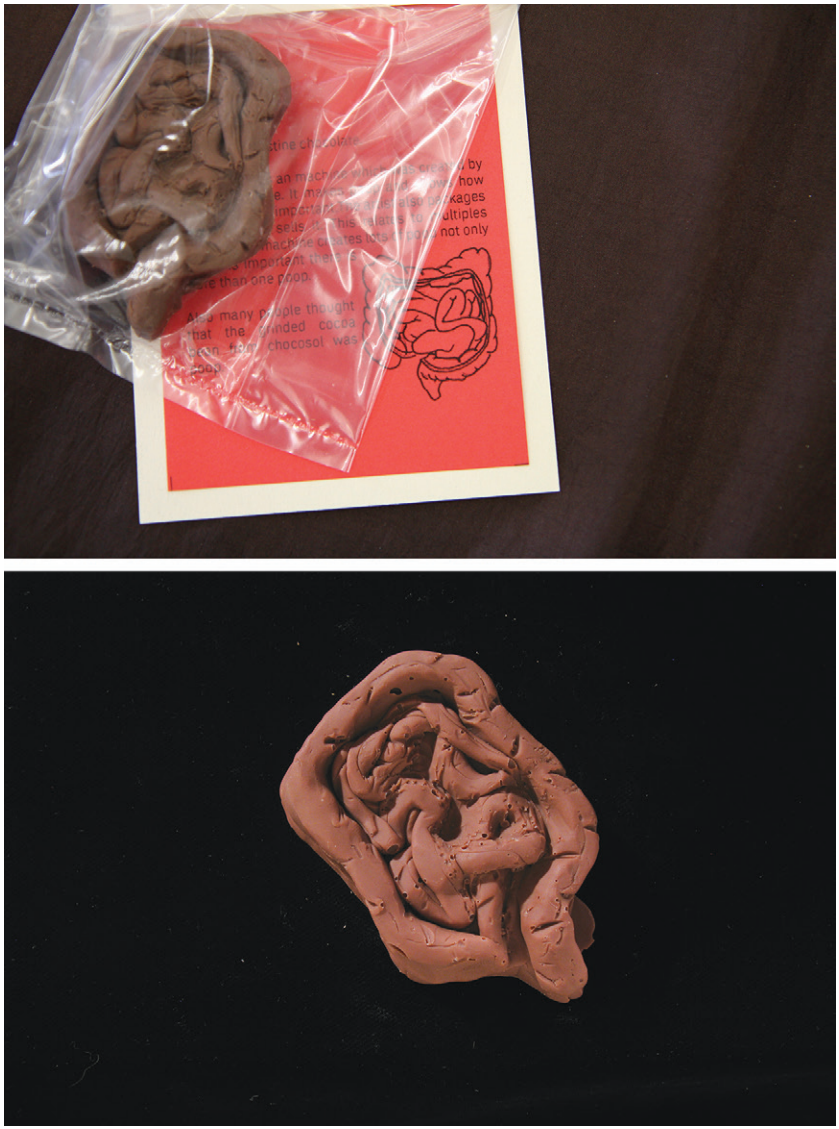

**Figure 5.1**
Grade 6 student Aski with visiting artists Hannah Jickling and Reed H. Reed, *Ask Me Chocolates: Aski's Intestine*, 2012. Chocolate. *Ask Me Chocolates* was commissioned by the Pedagogical Impulse. Photo credit: Hannah Jickling and Reed H. Reed. Courtesy of the artists.

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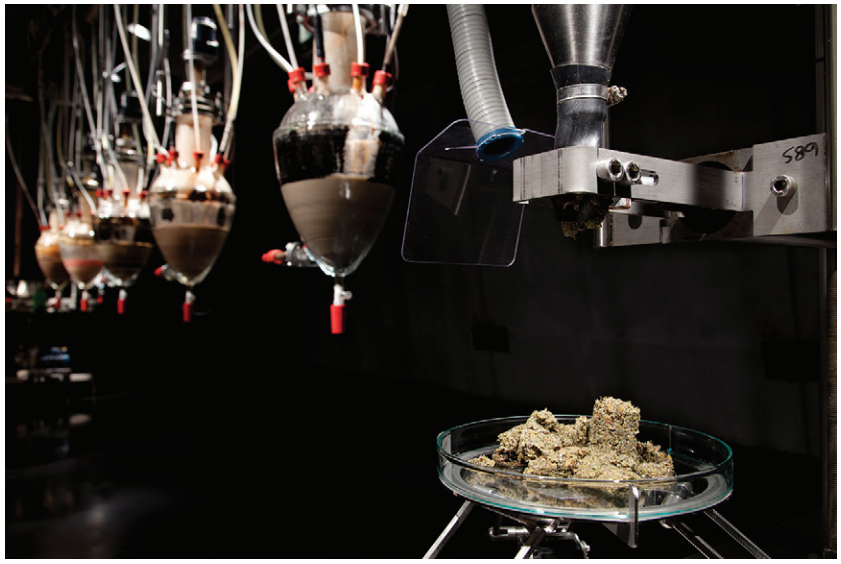

FIGURE 5.2
Wim Delvoye, *Cloaca Professional* (detail), 2010. Mixed media, 108 × 279.5 × 69 in. Collection MONA, Hobart. Photo credit: MONA / Rémi Chauvin. Image courtesy of the Museum of Old and New Art (MONA), Hobart, Tasmania, Australia. Copyright Wim Delvoye Studio, Belgium.

The *Cloacas* recontextualize material that "runs through" a body, seemingly without the encumbrance of an actual body. The vessels and tubing resemble equipment used to study digestion in laboratories, while the emergence of the fecal output recalls the ChocoSol Molino machine and clay coil extruder. Poop classroom materials—fecal matter, clay, chocolate—and their "clear associations" prompt a reevaluation of mechanical liveliness: if it poops, maybe *Cloaca* has a body after all. The fragility of *Cloaca*'s mechanical transitions between vats recalls Aski's emphasis on the movement and potential blockages of digested matter. The bundles of thin tubing materialize the vulnerability of a body's organ systems and how fiddly flesh flaps can easily become mixed up, tangled, and dysfunctional.[49] The permanent installation of *Cloaca Professional* at the Museum of Old and New Art in Hobart, Tasmania, has become one of the museum's "most hated" and simultaneously most popular attractions, with feedings at 11 a.m. and 4 p.m., and defecation at 2 p.m.[50]

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*Cloaca*'s garbage disposal mouth consumes a pleasingly plated meal from the museum's café, and when I was last there, the attendant feeding *Cloaca* explained that the machine, like us, sometimes suffers from diarrhea and constipation. Representatives from Australia's National Bowel Cancer Screening Program turned the *Cloaca Professional* installation into a poop classroom to educate the public about bowel cancer screening, capturing one of the *Cloaca*'s poos to demonstrate the collection process.[51]

When Livingston brings Delvoye's *Cloaca* to her students, she challenges "the field of art education," which "often avoids *difficult* art, usually meaning contemporary art." Contemporary art becomes an abject part of the art curriculum, ejected but never entirely separated from historically distant practices. Activating a productive tension between contemporary art and poo in the classroom, Livingston wants to encourage her students to know their bodies' processes and capacities "not through conquering them but by befriending them."[52] This advice recalls Mol's intervention into human exceptionalism. The world moves through the fluctuating boundaries of the metabolic body, embracing ambiguity, dialogue, and exchange instead of dismissing the abject as "not me. Not that." The abject is "not nothing, either"; for Kristeva, abject materials and processes are "the primers of my culture."[53] Humor in the elementary school classroom supports an expanded self that pays attention to and even befriends excrement. Poop classrooms transform body image to body process.

With clay and chocolate standing in for poo, becoming "gross" and "mega-gross," the children's relentless jokes bring poo and contemporary art into conversation and circulation.[54] The material and materiality of fecal matters matter; "the leakiness and unruliness of poo announced itself as a pedagogy of refusal, as a wilful failure."[55] Aligned with Sara Ahmed's resistant willfulness, scholar Stephanie Springgay shows how willful failure builds solidarity, refusing neoliberal concepts of trade and capitalism to "shape counterintuitive modes of knowing and being."[56]

Poop classrooms define abjection differently. The abject has been understood as the unfamiliar, "elaborated through a failure to recognize its kin," a scenario narrated by Kristeva where a frightened child, "all by himself," "rejects and throws up everything that is given to him."[57] When students in Jickling and Reed's poop classroom declare that "bitter

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We do a colonoscopy and then take the donor's stool solution...
Sort of failed every antibiotic treatment that he was on,
into what the bugs are in our gut...

FIGURE 5.3
Kathy High with Guy Schaffer and Alison Berkoy, stills from *Fecal Matters*, 2018. Video. *Fecal Matters* is a documentary interviewing science researchers in the field of gut microbial studies and fecal microbial transplants. Photo credit: Kathy High. Courtesy of Kathy High, youaremyfuture.com.

chocolate is for adults!" they hold little space for the lonely upper-class European children who haunt the history of psychoanalytic theory.[58] Instead, poop process art builds solidarity through "kid knowledge" about taste and waste. Grosz's hovering specter of abjection starts to resemble the long-running children's US television and film franchise Casper the Friendly Ghost.

A new genre of pooper embraces poop's agential and communicative capacities. High and Dumitriu exemplify this growing social and cultural (bowel) movement. Their multimodal transdisciplinary and collaborative installation, performance, and video projects make space for the unruliness and willfulness that Springgay identifies in the elementary school classroom. But even as these works unite audiences with the same ambivalent affects—"Gross!" "Mega-gross!"—that animate Jickling and Reed's classrooms, High and Dumitriu's poop classrooms stage a scatology-informed dialogue with fecal matter. Both artists insist that little brown messages must be heard.

High and Dumitriu engage the practical and philosophical potentials of FMT protocols. FMT is somewhat self-explanatory: all or part of the

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microbial community from the bowel of one person is transplanted into the bowel of another person. High's documentary *Fecal Matters* (2018) explores exactly how such transplants happen and some of the challenges faced by gut microbiome researchers, asking questions about donor selection, fecal screening and banking, and synthetic alternatives, including RePOOPulate, developed at the University of Guelph.[59] In conversation with interviewer and researcher Guy Schaffer, gastroenterologist Ari Grinspan talks viewers through an actual FMT procedure on a patient with *Clostridium difficile* whose bacteria have resisted five rounds of antibiotics. These engagements with fecal microbiota recall scholars Heather Paxson and Stefan Helmreich's observation that microbes are increasingly "welcomed as possible companions to contemporary human cultural projects."[60] By bringing biomedical processes into art spaces, High and Dumitriu amplify the cultural capacities of FMT to show how tiny microbes influence and impact global health issues.

To understand FMT, guts and microbes must be experienced as communicative and transmissible. Yong describes FMT as "an *ecosystem transplant*—an attempt to fix a faltering community by completely replacing it, like returfing a lawn that's overrun by dandelions." None of these procedures require tasting or eating poop. FMTs are administered with colonoscopies, enemas, or sometimes pills. But the same principle applies when animals eat one another's poop: coprophagy exposes their guts to new microbiomes. FMT has successfully treated persistent bacterial infections such as *Clostridium difficile* that often do not respond to repeated courses of antibiotics and thus can be chronic and debilitating. FMT has a long history; first mentioned in a fourth-century Chinese medical text, FMT also appears in the 1697 *Dreck-Apotheke* (*Salutary Filth Pharmacy*).[61] Although FMT works brilliantly for *Clostridium difficile*, its effectiveness in treating other illnesses linked with FMT experimentation (irritable bowel disease, obesity, and even autism) remains less certain.

Dumitriu's *Don't Try This at Home* (2015) was commissioned for the Eden Project's exhibition *Invisible You: The Human Microbiome*, contained within a geodesic biodome on the site of a former clay mine in Cornwall. Despite and because of its title, the sculpture begs to be tried at home, taking the form of an easily transported wooden box overflowing with tubing and anatomical glassware, its lid "carved with images of the *C*

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*diff* spores as they form biofilms in the gut."[62] Dumitriu regards bacteria "as a medium," and she frequently works with textiles that have been embedded in agar and inoculated with bacteria, as with the *MRSA Quilt* (2011) and *Antibiotic Resistance Quilt* (2017).[63] The inoculation process dyes the cotton, often with painterly effects. In *Don't Try This at Home*, the machine's "intestines" are made from calico cotton inoculated with FMT bacteria. As the glass colon twists and curves around, solid matter from the sterilized fecal transplant has formed sediment deposits. Dumitriu explains that if the exhibition had contained living bacteria, the glass vessel would have exploded as the bacteria released gas. The bacteria-infused calico intestines nestled inside the colon merge with a calico-covered tube that recalls the flexible tubes used to navigate the colon to administer a fecal transplant via a colonoscopy.

Many of Dumitriu's projects result from residencies in laboratories. Close, collaborative research demands learning new protocols and extensive trial and error. For *Don't Try This at Home*, she worked with Jane Freeman and Caroline Chilton from the Healthcare Associated Infection Research Group at the University of Leeds. When researchers invited her to "see their gut model," she was surprised by what they showed her:

> When they said "gut model," I thought: "Oh, gosh, it's going to be one of those computer models with a horrible screen with some little dots on it or something." I thought it was going to be really boring. But then they took me to see it and it was a room full of bubbling jars with pink liquid being fed in. The jars and chambers represented the different parts of the gut.[64]

Freeman and Chilton's biofilm gut model departs from both computer and in vitro models by suspending glass rods in one of the vessels "to study the formation and roles of complex, mixed-species intestinal biofilms."[65] Even though the laboratory gut model does not resemble the anatomical form of the intestines or colon, Dumitriu's sculpture evokes these bubbling jars as well as the clear containers of prepared FMT material observed in *Fecal Matters*.

Although seemingly the textural and aesthetic opposite of poop, glass has become a critical material for following digestion and metabolic waste. Glassware used in tissue culture techniques have transformed the experimental animal body from an "opaque solid" to "an interior set of

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life processes that had been extracted, distributed, and persuaded to live outside the body, glass-enclosed but always in full view," as described by scholar Hannah Landecker.[66] Digestion, too, has been coaxed into in vitro liveliness, moving from laboratories to art studios and back again. Digestion under glass and outside bodies can be smelled as well as seen. Dumitriu depicts the pungent smells of microbiology research, from the "boiled seaweed" smell of agar media to *Clostridium difficile*, which "smells a lot like farmyards."[67] Delvoye's stylized *Cloaca Professional* quotes the smells and forms of in vitro gut models created in laboratories.

High's *Bank of Abject Objects* (2016) brings anatomical forms and laboratory materials home. The glass spheres are partially filled with honey. Recalling the urine surrounding *Piss Christ*, the honey's warm hue makes the hand-sculpted ceramic poops contained in the vessels atmospheric and radiant. High explains that "the credit reads as 'Poop—Jillian Hirsch' purposely to allow for the slippage of people believing this is actual feces."[68] The honey's preservative qualities make the vessels a DIY solution to the stool-banking processes that are currently managed by institutions and laboratories. The title, *Bank of Abject Objects*, recuperates the abject from misreadings as rejected or disgusting through the archival work and value of banking. The scale, shape, and size of the *Bank*'s glassware—easily cradled, tucked under the arm, or moved from place to place—recall the common practice of sharing and exchanging homemade fermented foods outside industrial food systems.[69]

High and Dumitriu suggest other futures by creating other pasts. Archival research combines with the materials, methods, and practices of historical and cutting-edge biology. Bringing these modalities together in specific artworks and bodies of work writes historically absent voices back into the archive. Dumitriu's traveling FMT case adheres to conventions of museum display. This aesthetic animates speculative and archival knowledge about how people have been undertaking FMT all along, and carries within it a critique of which objects and practices get collected, and which drop off the edges of past and present curatorial practice.

High's *Bank* vessels and Dumitriu's anatomical glassware each evoke the experimental laboratory equipment of Challis Underdue, a speculative nineteenth-century biologist created by High and Schaffer in their homage to Laporte's eponymous book, *History of Shit* (2017). Twists, turns,

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FIGURE 5.4
Kathy High with Guy Schaffer, *History of Shit*, 2017. Mixed media. The *History of Shit* project is an homage to Dominique Laporte's book titled *History of Shit* (1978). As High and Schaffer note, "We are committed to re-imaging and re-inserting feminist and queer stories into our histories of medicine and science." Support from the Mütter Museum, the F. C. Wood Institute, and the College of Physicians of Philadelphia. Installation shot at University City's Science Center's Esther Klein Gallery, Philadelphia. Photo credit: Jamie Alvarez. Courtesy of Kathy High, youaremyfuture.com.

and lumps characterize Dumitriu's and Underdue's glassware. Research vessels quote anatomical form. High and Schaffer's archival photos and vitrine displays are carefully staged to blend archival traces from the past with speculative documentation of Underdue's life and work. Dumitriu's wooden case would look at home beside Underdue's experimental equipment.

Two historical figures bracket Underdue's fictive life and research. First, her work elaborates on published research she would have been familiar with, including physician David MacBride's *Experimental Essays on Medical and Philosophical Subjects* (1767). MacBride kept macerated food at body temperature, hypothesizing that digestion was a process of fermentation. Underdue's imagined research takes MacBride's protocols a step further to include fecal matter in fermentation experiments with her glass colon

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**Figure 5.5**
Kathy High with Guy Schaffer, *History of Shit*, 2017. Mixed media. Pictured, Challis Underdue, a scientist/researcher from the mid-1800s, in her lab. Described in "The Forgotten Scatomancer: Challis Underdue's Excremental Vitality and the *Medical Cultures of Modern Great Britain*," by Guy Schaffer. Photo credit: Shannon Johnson. Courtesy of Kathy High, youaremyfuture.com.

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vessels. Her journals record her results: "the vitality of excrement is necessary for the production of true excrement."[70] Underdue's "excremental vitality" prefigures the microbiome. In High and Schaffer's project, a speculative character writes speculative fiction. The narrator of Underdue's science fiction novella *The Inner Voyage* leads readers on a journey through the colon to the cecum to meet microbial populations characterized as "animalcules" (a now-outdated term for microorganisms). The microbiome rests in *The Inner Voyage*, banked and waiting for a historical moment capable of appreciating Underdue's vision of the microbiome as a queer, feminist space. Second, Underdue befriends James Miranda Barry, a (historical, not speculative) surgeon assigned female at birth who lived as a man for his entire adult life, beginning with his enrollment in medical school at the University of Edinburgh. After serving all over the world, Barry retired from his last post in Canada as inspector general of military hospitals in the British Army. High and Schaffer cast Barry as Underdue's imagined confidant and ally (and possibly lover), facilitating her work and informing her of scientific advances.

In addition to her knowledge of the microbiome, Underdue's story draws on contemporary details by incorporating key remarks from microbial ecologist Emma Allen-Vercoe (lead RePOOPulate researcher). In *Fecal Matters*, Allen-Vercoe describes the unique profiles of each person's poop: "Everyone's poop and everyone's ecosystem smells different."[71] As a child, Underdue learned to identify and distinguish between the individual smells of the night soil she and her father collected around London. Allen-Vercoe mentions a clinic that offers FMT as a spa therapy treatment; Schaffer includes the spa as the present-day site of Underdue's London home. Underdue was born in 1790 and published *The Inner Voyage* in 1851; her life coincides with the Industrial Revolution that gave the biosciences factory and fuel metaphors for metabolism and food. By reproducing the aesthetic sensibilities of this era, High, Schaffer, and Dumitriu complicate stories about metabolism's historical beginnings. Their speculative archives share life history with Landecker's reminder that contemporary metabolism research relies on bodies, environments, and microbes inherited from industrialization.

High groups these works under the umbrella title *You Are My Future*.[72] In addition to the *Fecal Matters* documentary, the *Bank of Abject Objects*,

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**Figure 5.6**
Kathy High, *Kathy as Bowie*, 2015. Photograph. *Kathy as Bowie* is a photographic series and attempted exchange with David Bowie. Photo credit: Eleanor Goldsmith. Courtesy of Kathy High, youaremyfuture.com.

and her collaboration with Schaffer on Underdue in *History of Shit*, the body of work includes *Landscape of Lost Microbes* (2017) and a self-portrait series, *Kathy as Bowie* (2015).[73] Asked whose poop she would most like to receive in a fecal transplant, High immediately replied, "David Bowie." The series of self-portraits as Bowie ask one of the critical questions in FMT research: How will changing a person's microbiome affect them? Returning to the change-the-past to change-the-future methods that inform the Underdue installation, to what degree might FMT change a person or even transform them into someone else? *Kathy as Bowie* includes a letter she wrote to singer-songwriter Bowie in 2015, shortly before his death (High was unaware he was ill when she wrote). High's letter combines the familiar fan mail genre with educational information about FMTs and the request to trade her series of self-portraits "for a throw away item. Your poo."[74] High's work emerges from her lived experience; as she explains

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to Bowie in her letter, she has Crohn's disease. This chronic inflammatory bowel disease can impact any part of the digestive tract. She has had more occasions than most to consider what her poo tells her. High has chosen to acknowledge how gut feelings confront the sanitation status quo to produce embodied ways of knowing otherwise. *You Are My Future* refuses to position poo as a throwaway item, instead insisting on its value, vitality, and communicative capacities. For High, the gut becomes "a hackable space."[75] Here, hackable indicates the complex entanglement between microbiome and world; FMT methods make singular subjectivity impossible.

FMT shows how microbial communities manipulate guts, bodies, and worlds. Mol's metabolic loops and spirals return to remind me how methods and forms can shape or dismantle human exceptionalism. Metabolic readings can be shared across guts and time, as with the stool bank concept, and can drift across bodies of water. The artworks in the next section are, in scholar Donna Haraway's words, "awash in urine."[76] Urine, too, can become a hackable space.

## Awash in Urine

Gallery goers consider the sculptural potential of a urinal, Warhol's ghost pissers create abstract forms with their spray, and a jar full of pee redefines Christ's golden luminous halo, but urine has been cleaned and tidied away from each of these works. Maggic and Abraham take a different approach. Their projects do not smell of or force an encounter with urine's material immediacy; instead, their work hinges on urine's chemical liveliness and capacity to link organism, environment, and global metabolisms. Although both artists know their way around the laboratory, their methods are developed within communities working outside official channels to leverage scientific protocols for mutual aid. While High and Dumitriu undertake long-term residencies in laboratories, Maggic and Abraham prefer to work outside the lab with everyday accessible materials.

Maggic's *Housewives Making Drugs* investigates urine's history and speculative future as a source of estrogen in HRT. Abraham's *Diabethanol* installation proposes transforming diabetic urine into biofuel to advocate for social and ecological justice. In both projects, urine circulates across

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FIGURE 5.7
Mary Maggic, *Housewives Making Drugs*, 2017. Video. Courtesy of Mary Maggic.

and between bodies of water. Recirculating waste connects excretory systems with environmental systems. These pathways model Neimanis's argument that, through watery connections, "the flows of global power meet the flows of biomatter."[77] Urine's chemistry brings new forms of life and new energies into the world.

Maggic's *Housewives Making Drugs* sits within *Open Source Estrogen* (2015–2017), a collaborative "freak science" initiative undertaken by Maggic and artist Byron Rich (this project includes *Egstrogen Farms*, seen in chapter 3). Maggic and Rich describe *Open Source Estrogen* as "a form of biotechnical civil disobedience" that "combines do-it-yourself science, body and gender politics, and ecological ramifications of the present."[78] *Open Source Estrogen* traverses writing, performance, videos, installation, speculative and authentic scientific protocols, and educational resources. They "began with a simple speculative question: What if it were possible to synthesize estrogen in the kitchen?"[79] The home kitchen becomes both a laboratory and revolutionary site. Maggic and Rich describe the kitchen as "a politically charged space prescribed to women as their proper dwelling, therefore making it the precise context to perform an estrogen synthesis recipe."[80] Elsewhere I have argued that "the kitchen is a site of knowledge production" and has become an increasingly important studio

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space for artists such as Maggic and Rich, whose practices "require hybrid spaces that are kitchens, labs, and gardens all at the same time."[81] Institutions such as hospitals and research libraries rarely accommodate such hybridity.

The *Housewives Making Drugs* video follows a trans woman who receives a notification that hormones are no longer covered by her health insurance. Lamenting the transphobic medical establishment that makes accessing hormones so difficult in the first place, she muses, "I wish there was a way to get hormones without a prescription." She and her partner gaze into the distance as the video fades out and cuts to a colorful kitchen where the couple has transformed into cooking show hosts Maria (Jade Phoenix) and Maria (Jade Renegade). They guide viewers through a DIY estrogen extraction protocol using a homemade filter device called the "Estrofeminizer." Maria explains that "our urine is chock full of unused hormones, and with the help of the Estrofeminizer, we can isolate just the estrogen."[82]

The Estrofeminizer clamps an inverted glass bottle to a stand, complete with colorful "Estrofem!" branding. Cigarette filters are packed into the neck of the bottle, while above them, silica gel fills the bottle's body. During a break from the cooking show, Maria rushes to the all-gender toilet in the courtyard, collects her urine, and passes it to a harried production assistant, emphasizing both the liveness of the cooking show format and rush of peeing during a commercial break. Maria pours the fresh urine through the filter and then extracts the isolated estrogen from the filters using methanol. After evaporating the methanol, the extracted estrogen contributes to a pink "estro-gin" and juice cocktail. Following a reflection on care and community responsibility, the studio audience joins Maria and Maria in the kitchen laboratory for a dance party. Maggic cautions viewers that the *Housewives Making Drugs* protocols are speculative with a disclaimer stating that "we are very far away from any at-home synthesis of hormones for HRT, birth control, menopausal symptoms, etc. that are replicants and/or alternatives to pharmaceutical offerings," while reminding viewers about "the already HUGE efforts of trans and women's rights organizations on setting up their own networks and resources for sharing and getting access to such hormones."[83]

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Patients might undergo hormone replacement therapy (HRT) with estrogen for various reasons: hormonal transition for trans women like Maria and Maria, menopausal women, people who have had hysterectomies, people who have had prostate cancer, and osteoporosis patients seeking to slow the breakdown of their bones. Everyone undergoing HRT becomes engaged with the networks of animals and manufacturing systems that support HRT. These more-than-human assemblages are, in Haraway's words, "awash in urine." Haraway reminds us that Emmenin, the first water-soluble estrogen developed in 1930, was "extracted from the urine of Canadian women in late stages of their pregnancies"—a supply chain that quickly proved unsustainable, prompting researchers to turn to pregnant horses. Premarin (a word between portmanteau and acronym, from "pregnant mare's urine") was available by 1941. Haraway acknowledges how her "menopausal self failed to know much about the pregnant mares and their disposable foals." She now seeks to "conjugate" estrogens, "yoking molecules and species together in consequential ways."[84] Maggic and Abraham's work conjugates in an analogous mode, following the energetic and chemical compositions of metabolic processes to compose speculative scenarios that question status quo approaches to hormones, gender, health, and fossil fuel use.

Maggic undoes essentialist links between sex and embodiment, emphasizing how hormones are "responsible for the basic homeostasis of the body" and need not be regarded as a "black box" for gender, where estrogen or testosterone goes in and femininity or masculinity pops out the other side.[85] Scholar Eva Hayward finds in Premarin an example of "transxenoestrogenesis," an "overgrown, weedy" word developed to describe "a toxic, expressive, resilient, and ethico-politically problematic form of species symbiosis that undoes sex and embodiment as we know it." Hayward attends to how horses interrupt the potential black boxing of sex transition, making sex transition from male to female a more-than-human process.[86] Including the prefix "xeno-" (foreign) hints at further complications. Xenoestrogens or environmental estrogens are hormones produced outside the body's skin boundary. Xenoestrogens might occur naturally in plants and fungi, but increasingly they are the manufactured result of pollution and plastics. Plastics make xenoestrogens a forever

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problem. The "plastisphere" captures the extreme longevity of plastic, which for Heather Davis, "exists outside of the proper logics of decay and transformation, in its own category of creation," capable of releasing xenohormones for generations to come.[87]

Xenoestrogens created by plastic pollution change and queer reproduction and sex. Maggic's research uncovered an "Estroworld" that was bigger than cooking hormones in the kitchen: "environmental toxicity reveal[s] a strange tension between *active* queering (through gaining access to hormonal therapies) and the *passive* queering that happens unbeknownst to almost every organism on the planet."[88] *Housewives Making Drugs*, then, envisions DIY access to hormones that refuses human exceptionalism. Waste recirculates and returns to multispecies metabolic systems. Harvesting hormones from people instead of horses and sharing those hormones across bodies, as seen in the estro-gin cocktail party, proposes hormonal gestation unmoored from sexual reproduction. The project maintains Mol's metabolic loops and spirals, reactivating urine rather than flushing it away. *Housewives Making Drugs* liberates hormone consumers from a transphobic and inaccessible medical system.

Abraham's *Diabethanol* repurposes urine to link a global health crisis, diabetes, with the global energy crisis. Often figured as a key that can unlock the doors of cells to let glucose come inside, when insulin cannot be produced at sufficient volume, glucose cannot be used in cells. In Indonesia, Abraham's home, both diabetes and energy use are critical issues. Indonesian health care services have prioritized educating people about how to manage their diabetes, which is a significant cause of death.[89] At the same time, Indonesia aims to increase its renewable energy in its most recent electricity plan.

*Diabethanol* combines ideas about waste and the circular economy with the visual language of start-up culture, presenting products derived from diabetic urine and the inventions required to repurpose this specific resource. At the center of the *Diabethanol* installation in the 2018 Biennale of Sydney, a large white appliance plumbs a toilet into gasoline pumps offering E25 and E85 fuel. An array of gleaming white pipes and tanks connect the toilet to the pumps, implying a transformative process within this hybrid appliance. In addition to a slick explanatory video, the installation includes a shelf of white plastic jugs of Diabetilizer,

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**Figure 5.8**
Julian Abraham "Togar," *Diabethanol*, 2018. Detail, mixed-media installation, dimensions variable. Commissioned by the Biennale of Sydney with generous assistance from the Australia-ASEAN Council and the Australia-Indonesia Institute of the Department of Foreign Affairs and Trade. Installation view of the twenty-first Biennale of Sydney (2018) on Cockatoo Island. Photograph: Silversalt Photography. Courtesy of the artist.

"professional organic fertilizer," and a shelf of glass bottles containing Diabevodka, "crafted with diabetic urine." Posters on the walls seek investors for these new technologies.

*Diabethanol* began with Abraham wondering about how diabetic urine might become a fuel source. The project's outcomes are inspired by "an Indonesian saying, 'Mengambil kesempatan dalam kesempitan' which can be translated into something like 'take a chance in a tide.' . . . In a negative manner, the phrase is used for people who are benefiting out of someone else's difficult situation. In a positive manner, the phrase means 'make best out of something.'"[90] Diabetic urine engages both meanings of *mengambil kesempatan dalam kesempitan*, with *Diabethanol* producers and users benefiting from and making the best out of diabetes. The chemistry behind *Diabethanol* relates to findings that ethanol levels increase in diabetic urine when stored at room temperature.[91] In a letter to the

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editor of the *Lancet*, the authors of this study narrate the case of a sober woman charged with driving under the influence of alcohol because her undiagnosed diabetes caused the "spontaneous generation of ethanol."[92] Abraham's project shifts the relationship between car, urine, and driver, proposing that ethanol from urine could fuel cars instead of intoxicating their drivers.

Urine has always been helpful around the house, especially after decaying into ammonia, a common ingredient in cleaning products that also softens leather and sets dye. *Housewives Making Drugs* and *Diabethanol* couple urine's well-established everyday utility with a vision for metabolic savings rather than waste. As with banked FMT matter, urine becomes a shared resource. Maggic calls this "the fluid commons," Neimanis labels this "hydrofeminism," and curator Bronwyn Bailey-Charteris dubs this collectivity "the Hydrocene."[93] Urine contributes to body autonomy, renewable energy, and even extraterrestrial life (as with Michael Burton's *Astronomical Bodies*, discussed in the previous chapter). All of these "gestational relations" nourish and give life without giving birth.[94] Nonbinary, trans, and diabetic bodies make "chemosocial" contributions to the fluid commons.[95]

## Dietary Sources

Rich histories of food contrast with sparse histories of shit, given abundant archival resources for food (cookbooks, recipes, and images) and the lack of anything comparable for feces. Even though food becomes shit after less than a day in the body, food's cultural contexts are "erased as the food turns into the bolus inside the large intestine and then into the shit as it exits."[96] What would happen if poop culture had the same visibility and communicative power as food culture? Poop classrooms, poop communication, and the fluid commons meet in Cassils's *$HT Coin*. Sold as physical cans and nonfungible tokens (NFTs), *$HT Coin* reinvents Manzoni's *Artist's Shit* to connect history, diet, and identity to excrement.

Posting using the pseudonym White Male Artist, Cassils's *$HT Coin* Instagram profile leveraged a buzzy and peaking cryptocurrency and NFT art market to excrete, mint, and sell a month's worth of customized turds based on the diets of best-selling white male artists. The project

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FIGURE 5.9
(*top left*) Cassils, *$HT Coin: After Warhol*, 2021. By White Male Artist. Tin can, printed paper, and excrement (Coca-Cola, cornflakes, frozen hot chocolate, serendipity 3, Campbell's tomato soup, pheasant, mushroom, banana, beef, jam sandwich, chocolate bar, white bread, and mock turtle soup). Courtesy of the artist. (*top right*) Cassils, *$HT Coin: After Beuys*, 2021. By White Male Artist. Tin can, printed paper, and excrement (fruits, garlic, dough, herbs, coffee, wheat, milk, fresh vegetables, peeled potatoes, sliced carrots, lemons, grilled fishbone, leftover fish, honey, milk, apples, beer, sausage, bread, butter, alcohol, dried meat, eggs, peas, cookies, olive oil, oranges, rice, salt, cake, chocolate, mineral water, bacon, tea, soybeans, sugar, mushrooms, Maggi-Würze soy sauce, sauerkraut, salted cod, onions, lard, garlic cloves, margarine, rosemary, bay, thyme, sage, salt, pepper, hot chili pepper, and red wine). Courtesy of the artist. (*bottom left*) Cassils, *$HT Coin: After Cassils*, 2021. By White Male Artist. Tin can, printed paper, and excrement (hot water, freshly squeezed lemon juice, fresh strawberries, frozen banana, peanut butter, fat-free plain Greek yogurt, ice cubes, green tea, purple and green cabbage, red and yellow peppers, avocados, hemp oil, lime juice, hemp seeds, cilantro, green juice, cod fillet, asparagus, spring onions, basil, garlic, ginger, soy sauce, olive oil, and cracked black pepper). Courtesy of the artist. (*bottom right*) Cassils, *$HT Coin: After McCarthy*, 2021. By White Male Artist. Tin can, printed paper, and excrement (prosciutto, roasted grapes, goat cheese toast, arugula, saba, fruit, water, hot dogs, ground meat, ketchup, chocolate syrup, margarine, mustard, mayonnaise, raw steak, yellow cake, chocolate frosting, multicolored sprinkles, cold cream, tuna fish, butter, coq au vin with potato puree, chanterelles, pearl onions, red-wine-poached pear, pain de genes, and mascarpone). Courtesy of the artist.

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culminated with the simultaneous reveal of Cassils's identity and a Phillips auction house sale of the final five cans—those of Cassils, Andy Warhol, Jeff Koons, Damien Hirst, and Banksy. Following Manzoni, each of the final five cans had a reserve price equal to the price of gold (at the time, approximately $1,800). Cassils's can sold for the highest price.

Each materials list begins the same way as Manzoni's materials list for *Artist's Shit*—"tin can, printed paper, and excrement"—but Cassils elaborates with a parenthetical description of the food they ate before canning each batch. The cans supplement Manzoni's French and English labels with a "nutrition facts" label. The familiar font and format of the US Food and Drug Administration labels adapts to describe the parameters of the performance that produced each can, totaling the timeline, calories, fat, and cholesterol consumed. Printed on physical and NFT versions of each can, the ingredients list on the nutrition facts label reflects detailed archival research. Sometimes foods are famously incorporated into the artist's work, such as Warhol and Campbell's tomato soup, and Paul McCarthy and hot dogs. At other times, digging deeper, diets are gleaned from casual asides within interviews and profiles (*Vanity Fair* mentions the Zone bars stocked in Koons's domestic spaces), menus developed for exhibition venues (the Tate Modern's *Bruce Nauman Inspired Dining* program), or recipes of the artist's invention (Robyn Lea compiled the cookbook *Dinner with Jackson Pollock: Recipes, Art and Nature*.)[97] The can based on Cassils's own diet offers a metabolic reading of the food digested by "the most financially successful contemporary (white male) artists."[98] Their "much needed detox diet" includes greens, fruit, vegetables, and fish.[99] *$HT Coin* contributes to calls for a "sustained and serious study of the social and cultural roles of shit."[100] Cassils's diet compensates, heals, and works toward health in a toxic environment by undertaking a critical metabolic reading of a white supremacist art market. Detox diet principles expand to include detox from patriarchy.

Each ingredient list transmutes the familiar art historical and occasionally hagiographical value of food and eating into what at first appear to be reenactments of past digestions and defecations. But food and shit are not the same. Metabolic pathways have carried away, transformed, and picked clean much of the nutritional value of each can's ingredients list. Cassils pushes the questions about artistic intention and authorship that

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animate Manzoni's cans into a metabolic register. Excrement composed of these diets contains an entirely different shadow list of ingredients that would account for the microbial composition of the artist's gut—a composition that would change through time as they subjected their microbiome to the opulent and wildly different diets of white male art stars. Cassils has already outlived Manzoni, whose ingestions surely contributed to his death from liver disease. Metabolic function overtakes author function by centering endurance, body process, and bodily capacity.[101]

*$HT Coin* brings the humor, willfulness, and curiosity of poop classrooms into dialogue with the microbiome awareness and lived experiences of artist-scatologists such as High and Dumitriu. The artist's multiple collides with the performance of daily, disciplined diet, digestion, and excretion. Cassils's poop classroom illuminates "a parallel between the 'boys club' of cryptocurrency and the preponderance of white male artists leading auction sales."[102] The oppressive and exclusive social structures of boys' clubs manifest metabolically in the physical challenge of maintaining regularity while consuming the excessive diets of best-selling white male artists. These diets include the foods from Warhol, Koons, and McCarthy mentioned above along with additional foods from a bigger list of white male artists that includes chocolate, caviar, ice cream, caramel fondue, and stuffed tongue. How might the diets of others change eaters in unexpected ways, as with High's speculative Bowie FMT? How to recover from subjecting the microbiome to the "gender and racial inequality . . . within the greater arts and crypto community"?[103] Metabolic readings are art methods and historical methodologies. Art markets and art history are metabolized and excreted to understand and resist specific inequities and forms of privilege.

Gut microbiotas transplant between bodies, the fluid commons yield hormones and fuel, and the overstuffed diets of art stars and cryptobros critique power structures from below. Methods of "sharing suffering" witnessed in Beatriz da Costa's *Dying for the Other* from chapter 3 return with the forms and methods gathered in this chapter.[104] High transforms a lived experience marked by discomfort and medical intervention into a speculative feminist space capable of changing the past to change the future—an aesthetic and archival strategy shared by Dumitriu. Cassils subjects their body to the fatal harms of systems that have historically

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excluded them. Not only do they emerge alive and well, but they offer tactics for both nutritional healing and financial support to their community. With a lingering stare into José Muñoz's "queerness as horizon," Maggic's Maria and Maria cut from their inadequate health care reality to a kitchen laboratory that hosts liberatory urinations and transformations.[105] Meanwhile, Abraham takes a chance on a tide to renovate and care for combined medical and bodily waste. When a world moves through a body, transformed and changed by the journey, extractionist modes become difficult to maintain. Transforming metabolic waste into expansive metabolic resources means rejecting the "fantasy of the excrementless body" and understanding abjection's communicative capacities.[106] Instead of "radically separate, loathsome. Not me. Not that," urine and feces become radically intimate, not only me, but we: gestational, communal, and willful.[107]

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# 6

# Holobionts against Representation

Individual organisms have been understood by philosophers and biologists to be separated from their environment by their sensory apparatus, apparent body boundaries (membranes, feathers, fur, and skin), unique genome, and evolutionary path. But none of these principles of individuality hold when life-forms are understood as multispecies ensembles. Evolutionary development biologist Scott Gilbert invites readers to "think of a cow" doing cow activities: eating grass, chewing cud, and farting methane.[1] When a person "thinks of a cow," the cow might coalesce into a body image, something akin to a photograph, realistic drawing, or even a pastoral scene—a "thought bubble," like in a cartoon. If the person thinking of a cow limits their senses to this format, the cow might appear to be distinct from their surrounding environment, with her size, shape, and features evidence of generations of evolution and breeding. But thinking of a cow may invite additional senses. Thinking of a cow could include sense memories of the taste of milk, or sense memories of spaces culturally associated with cows. People who have a direct experience of cows may bring a more complex crossmodal experience, sensing distinctions between raw and pasteurized milk, how cows smell, and how cows smell in different environments, from idyllic pastures to urban streets to intensive dairy farms.

Gilbert explains that the cow cannot digest cellulose without the microbes in her gut. This multispecies gut environment "makes the cow possible."[2] The cow shares a life history with microbes, and these microbes facilitate her metabolic processes. As with FMTs, metabolisms are collaborative spaces where multispecies actors work together. The person who "thinks" a cow with vision will have a more difficult time understanding

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the cow as a collaborative multispecies ensemble than the person who thinks with additional senses. Crossmodal configurations that include smell may be most helpful, as the cow's microbes and digestion processes are viscerally and pungently smelly and smell differently depending on the cow's situation. Gilbert's text stages the cow's biological individuality with vision and visual cues such as the cow's skin, shape, and other evidence of her genetic traits and breeding. For readers accustomed to looking at figures printed on a page, "thinking of a cow" becomes synonymous with "looking at an illustration of a cow." Individuality and the conventions of scientific illustration reinforce one another.

This interdependence between mammals and their microbiota makes them holobionts (combining "holo," as in whole or entire, and "biont," as in modes of life). Holobiont has been defined as "the animal or plant with all of its associated microorganisms," "an organism plus its persistent communities of symbionts," and least hierarchically, biologist Lynn Margulis's definition, informed by lichens, which avoids the word "host" as well as the possessive "its": "*symbiosis (holobiont)*: association throughout a significant portion of the life history."[3] As with the cow, holobionts work across species to cometabolize. The holobiont redirects what scholar Val Plumwood calls "ecological embodiment."[4] Plumwood looks outward, placing bodies within the broader food chain—one can both eat and be eaten—but this "ecological view" could look inward and become a microscopic view that invokes the symbiotic gut. Embodied beings are embedded in and are ecologies: the cow holobiont has a "community metabolism."[5] But when I think of a cow, if I only use my eyes, I still perceive a cow, not a community, and not a holobiont.

Holobionts are difficult to perceive because humanist notions of individuality along with the resulting visual approaches to representation are so entrenched. How might holobionts be understood to be complicating, resisting, and transforming representationalism? If representations depend on notions of individuality linked to vision, holobionts demand recognition by other means. Holobionts are constitutionally incapable of dissecting the common sense. They depend on "diffractive" and metabolic readings to be understood.[6] Becoming holobiont offers a significant pathway into retrieving the misplaced common sense, but the question of how people might become holobiont remains open. To be perceived,

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holobionts must thoroughly renovate representationalism. The immersive and tactile qualities of contemporary performance and installation art offer guided experiences that allow participants to attune to holobiont lifeworlds. These works make worlds that challenge and reconfigure individualism and representationalism to mediate the risks of disembodied views from above.[7] Touching on figuring, illustrating, and rendering, conceptual and practical tactics emerge for sensing the holobiont.

This chapter engages holobionts of various kinds, and follows methods that move across scientific illustration and research-creation. These metabolic methods develop sensory tactics to negotiate and nourish differences between contemporary art and science practices as well as holobionts and people accustomed to traditional notions of biological individuality. Projects from artists Ken Yonetani and Julia Yonetani, the Institute for Figuring (IFF), Laurie Palmer, Bug Carlson, and Tessa Zettel and Sumugan Sivanesan follow coral and lichen from sea to rock to futures and back. Eva Hayward's questions about identifying with radically other life-forms suggest the political stakes of holobiont recognition. The chapter concludes with artist Jenna Sutela's video *Holobiont* (2018), asking how to sense what cannot be seen.

When scholar Sophia Roosth was asked to give a lecture on "the organism" while pregnant, she returned to the nineteenth-century ideas about biological individuality outlined above: "I realized that, as a pregnant person, I did not qualify! I no longer had an isolable body nor an exterior that was my own. I was no longer genetically separate from any other living thing. I wasn't metabolically self-sufficient."[8] Roosth's insight prompts her to question how women might have written science differently. Would Western people have understood themselves as holobionts earlier if women had been scripting science? Pregnancy offers dramatic evidence of interdependence, but microbes undo biological individuality as thoroughly as a fetus. Gilbert points to breast milk as an example of how cometabolism in pregnancy links the microbial communities of the mother and baby: "A mother has two sets of nutrients in her milk—one set for the newborn and one set for the bacteria that will help finish the construction of its gut capillaries and lymphoid tissues." As with the cow's grass, breast milk can only be digested by the holobiont cometabolism, so "'birth' is not the birth of a so-called individual. Birth is the continuation

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of the holobiont community."[9] Defining holobionts as "ecological units" makes their continuity across generations more intuitive.[10] Ecologies persist and survive through many big and tiny lives; birth contributes to an ongoing ecology rather than generating a new world.

Representationalism and the fractured five senses are historically produced by culturally specific conditions. Scholars David Howes and Constance Classen trace "a connection between individualism and sensory isolationism," resulting in the loss of "the unifying 'common sense'" in the seventeenth century.[11] The modern Western sensorium resembles the definition of biological individuality: the individual seeing subject moves around and apprehends the world at a distance. The senses orbit around this unfettered sighted observer.[12] Scholar Karen Barad explains how representationalism depends on regarding representation and represented as essentially different: "That which is represented is held to be independent of all practices of representing. That is, there are assumed to be two distinct and independent kinds of entities—representations and entities to be represented."[13] Five-sense sensoriums reinforce what Barad describes as independence between represented and representation. Representationalism relies on a hierarchy of the senses that puts vision at the top, allowing an individual viewer to observe the world from a distance. Barad's "posthumanist performativity" and diffractive readings close this distance by challenging representationalism. Such challenges can be extended to contest biological individuality and reclaim a common sense.

Digestion offers an embodied understanding of actively participating matter, while metabolism, with its interdependent pathways seeking homeostasis, refuses the distance of vision representationalism demands. Inside these pathways, as scholar Annemarie Mol writes, "Subject and object interfere with each other, change each other, intertwine. Rather than representing, other relational modalities are at stake."[14] In Barad's posthumanist performativity framework, observed and observer both matter, act, and shape encounter. Distance, objectivity, and individuality become impossible to maintain, reinforcing scholar Donna Haraway's argument that the distant observer has a weaker claim to objectivity than someone who is positioned and embedded in a specific context.[15] Barad turns to physics to scaffold posthumanist performativity. Eating and digestion provide entanglements of their own. Because eating cannot

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happen from a distance, digestion engulfs and muddles together fractured senses.

Vision can (and does) occur "in" bodies, and taste and smell are not so bound by bodily interiors that they cannot be collective, "perceptive," or even objective.[16] Mol references a taste laboratory where panels of trained participants "coordinate their palettes."[17] Scholar Bruno Latour finds that smell can be similarly perceptive, following "the training of 'noses' for the perfume industry through the use of '*malettes à odeurs*' (odour kits)," devices that allow users to train and calibrate their olfactory capacities.[18] Mol's taste laboratory and Latour's noses form social collective knowledge. Training the taste panel and the noses stretches the capacities of cracked senses, but this analogy does not quite extend to become a lived ecological view of the holobiont sensorium.

The arts have operated within a logic of representationalism too. Representing three-dimensional space in two dimensions using the conventions of perspective assumes a single viewpoint, with cameras standing in for eyes, and even abstract visual forms are closely associated with the individual vision of expressive creators.[19] The idea that the artist possesses a unique visual genius makes (white male) artists the most individual of biological individuals—a situation ripe for interventions such as Cassils's *$HT Coin* in chapter 5. Scientific illustrations traditionally adhere to conventions for representing three dimensions in two dimensions: photorealism, perspective, and static data displays. The majority of data visualizations, scientific illustrations, and figures follow these familiar formats. Photorealistic depictions of individuated organisms and data organized into charts and graphs depend on specialist visual literacies to be understood. Efforts to represent the holobiont usually obscure more than they reveal. Illustrations of the microbiome often show a recognizably human figure pierced by detail bubbles containing closer views of various microbes, seen as if through a microscope. Sometimes clouds of microbes surround or fill the outlined figure. The illustrated body contains, corrals, and possesses "their" microorganisms.

Similar to the holobiont, metabolisms exceed representation and data visualization. Even when illustrations focus on a specific pathway or reaction, metabolisms refuse isolation. Instead of depicting characteristics that can be seen and agreed on, as might happen when drawing from

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life, metabolic illustrators must render processes that might be known and understood but cannot be perceived with the eyes. Protein folding, cell respiration, and the composition of gut microbiota each return to chapter 4's discussion of "unseeable biology."[20] Consequently, each complicates or escapes representational frameworks. Scholar James Griesemer asks, "How is one to understand scientific practice if our tools for understanding are built solely out of logics of representation?"[21] To find and create other tools, in this chapter I attend to the feelings of engulfment and saturation that accompany research-creation focused on ecological and microscopic views and sensations.

In chapter 5, feces became a way to communicate with the microbiota that makes us possible. Remembering the dark blips between mouth and anus in Pipilotti Rist's *Mutaflor*, these microbial interiors are not visually perceptible. To inhabit a holobiont perspective, senses beyond vision must be mobilized.

Feminist, queer, bioart, installation, and performance projects have been negotiating a crisis in representation for decades. Immersive, embodied research-creation practices are well positioned to offer metabolic readings of the holobiont's complexities. The projects I attend to below revolve around corals and lichens, neither of which are humanoid or easy to understand through touch or shared sensation. Coral and lichen are critical teaching organisms in biology, and are at the heart of the symbiotic world making accessed by Margulis and propelled in different directions by biologists and theorists, including Gilbert and Haraway. For Haraway, because coral and lichen are "the earliest instances of symbiosis recognized by biologists; these are the critters that taught biologists to understand the parochialism of their own ideas of individuals and collectives. These critters taught people like me that we are all lichens, all coral."[22]

How does a person begin to understand themself as a lichen or coral? In chapter 3, physician David Servan-Schreiber and artist Beatriz da Costa realized their bodies and digestive systems were "terrain." Adopting this ecological soil metaphor to understand the principles of an anticancer diet acknowledges their bodies, including their cancers, as holobiont communities. Similar to Haraway and her biologist kin, Servan-Schreiber had to reevaluate his medical training and assumptions. Becoming a coral

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or lichen demands a shift away from representational forms of identification and embodiment. Da Costa's *Dying for the Other* cuts across spatial and multispecies layers between kale, research mice, and oncology wards—a move that could help with understanding bodies as holobiont ensembles. Most days, my image in the mirror will not resemble a coral or lichen. If I understand myself to be a coral or lichen—that is, if I understand myself to be a holobiont—this understanding must happen in registers beyond vision. Perhaps, as with Servan-Schreiber, da Costa, and the anticancer diet, these registers are metabolic.

But first, an important caveat: identifying with, recognizing myself as, or even perceiving holobionts may be impossible ambitions. Myra Hird and Nigel Clark remind us that "in an ontological sense, what it is to be a bacterium, or more appositely, a vast meshwork of interacting bacteria, is . . . beyond our grasp."[23] Bacteria and other microbes operate in ways that cannot be fully understood or even perceived by humanist senses, even as they make those senses possible (the eyes, ears, mouth, and skin, as with the rest of the body, share life history with hundreds of bacterial species). While eating an apple, Mol confronts a situation where some processes escape perception: "A person cannot train the internal linings of her bowels in a way that begins to resemble the training of her muscles. I may eat many apples, but I will never master which of their sugars, minerals, vitamins, fibres are absorbed; and which others I discard. How to give words to this mode of being a subject?"[24] Holobiont might be one possible word for this mode of subjectivity. Mol's "I," a pronoun linked to biological individuality, will never master metabolism because as with the cow's grass, the "I" does not digest; the ecological collective cofacilitates digestion. Microbial lifeworlds beyond our grasp simultaneously *are* our grasp. Making cultural and biological space for understanding shared life histories depends on accepting the limits of primate vision, knowledge, control, and domination.

## Science Performance Cultures and Alien Embodiment

Scientific work shares vocabularies and strategies with contemporary art practices. Making such work public increasingly demands time-based,

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process-driven, and participatory approaches to science communication and illustration. Asking if illustrators have "come from the crude woodblock to slick airbrush, . . . what is the next step?" *National Geographic* art director Howard Paine admits to "looking for something more, . . . and wondering who will find some innovative and exciting new forms of illustration." Writing in 1980, Paine mentions "3-D" and "the elusive hologram" as examples of what the future might bring.[25] In his exploration of three-dimensional models along with their capacity to produce both knowledge and what he calls "word–world relations," Griesemer argues that "the philosophy of scientific representations needs rethinking, perhaps from a ('4-D'?) perspective on science as a process."[26] Jen Christiansen, senior graphics editor at *Scientific American* (and who also worked for *National Geographic*), turns to art and performance programs for "lessons of audience engagement and dialogue," agreeing with Paine and Griesemer that scientific illustration could and should extend beyond the two-dimensional page.[27]

Both science and art have lost many of the referents that propped up representationalism. Laboratory research can be and usually is processual, embodied, and multidimensional. Roosth describes synthetic biology research as "*interested making*, making with a question attached," using language that would be at home in many contemporary art studios. Roosth cites historians Lorraine Daston and Peter Galison's assertion that "science has recently transitioned from an age of scientific *representation* to one of *presentation*, in which the acts of 'making and seeing are indistinguishable.'"[28] Here, "presentation" suggests how material agency makes distinguishing between representation and represented impossible—claims that resonate with Barad's posthumanist performativity. Perhaps the individual organism has been metabolized and transformed into the symbiotic holobiont in the same way that perspective and naturalism have shape-shifted into abstraction and conceptual approaches in the arts.

Performance and movement access radically other forms of embodiment. In her work with protein modelers, scholar Natasha Myers argues that "the visual cultures of science must be understood simultaneously as performance cultures."[29] Protein modelers build three-dimensional models of looping, folding nanoscale molecules—more unseeable biology.

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At first glance, protein renderings might appear to be representations or adhere to representationalism: a protein and a representation of a protein. Aligned with Barad's posthumanist performativity, Myers shows how the process of modeling undermines such logics. Her analysis extends far beyond the obvious problem that proteins are too small to be seen with the eyes. First, proteins "breathe" and so cannot be adequately represented by "the static data forms that are published in scientific papers." Without specialist knowledge, a viewer cannot connect flat representations with the movement and activity that characterize the rendered protein. Second, protein modelers use their bodies in motion to illustrate what molecules are doing: "they get entangled—*kinesthetically* and *affectively*—in their modeling efforts."[30] Myers turns to Robert Alan Weiss's *Protein Synthesis: An Epic on the Cellular Level* (1971, discussed in chapter 4) and more recent "Dance Your PhD" competitions to connect science research with "body experiments" through movement, formations, and "molecular dance."[31] In the lab, when modelers use movement to communicate unseeable biology, success depends on the willingness of other scientists to respond by iterating and elaborating on kinetic forms with their bodies.

This shared kinesthesia recalls philosopher Barbara Montero's research on "proprioception as an aesthetic sense." Myers asks what happens when dance renders molecular structures, and how the shared expertise of dance audiences amplifies what Montero describes as "proprioceptive awareness we receive about the movements of others."[32] Molecular dance links proprioceptive awareness with knowledge about protein structures. Body experiments undermine representational logics by sharing knowledge across bodies and mobilizing crossmodal capacities, challenging the autonomous individuality privileged by predominantly visual formats. As vital as they may be in the lab, body experiments are not included as figures in published papers. Even as "radical experimental methodological projects flourish," scholar Kat Jungnickel laments how "it is far less common to see research made and communicated publicly in similarly risky cutting edge forms."[33] The kinesthetic, olfactory, and haptic processes that activate laboratory research consistently fall away from the text, charts, and illustrations included in publications. Although large events such as *Protein Synthesis: An Epic on the Cellular Level* are compelling and risky illustrations of scientific processes, and crochet has allowed

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mathematicians to understand hyperbolic space (more on this below), including embodied experiences of dance and crochet in scientific papers would require new approaches to making science public.

When and why did the conventions of contemporary art practice stop being integrated into science illustration? Contemporary art embraces installations, performance art, participatory art, and immersive experiences from sculptural enclosures to virtual reality. Although virtual reality has become a lively site of scientific visualization, Paine's hopes for 3-D and holograms have not materialized. Instead, with some compelling exceptions, scientific illustration accompanying findings published in journals remains limited by the two-dimensional page, despite evidence that scientists themselves embrace immersive performance, time-based, intermedia, and research-creation methods that have informed contemporary art for nearly a century.[34]

A turn away from recognizable human forms opens up space for contemporary practices to intrude on scientific illustration and metabolize the legacies of figurative practice. Corals and lichen may be as anatomically other from people as an organism can be. Among the first beings to be recognized as holobionts, corals are incredibly diverse. Countless exceptions complicate the following descriptions of their form and composition. Coral colonies gather thousands of coral polyps, which are soft and gelatinous (similar to jellyfish or anemones). Often these polyps are clones of one another, but coral also reproduce sexually, staging dramatic spawning events. Hard coral polyps excrete corallite at their base, slowly building the "skeleton" of the coral. The accumulation of these tiny extrusions makes coral a foundation species, meaning that corals engineer entire habitats: coral reefs. Reefs are living ecosystems because each polyp has a symbiotic relationship with photosynthetic algae, mostly single-celled dinoflagellates or zooxanthellae. The polyp shelters the algae and provides carbon dioxide, and the algae create oxygen that sustains the entire colony. Coral bleaching occurs when the reef becomes stressed by environmental changes, which can include warming water, overfishing, and agricultural runoff. Bleaching events cause the polyps to eject their symbiotic algae, taking away the polyp's color and revealing the white exoskeleton underneath. Bleached coral will most likely die; if symbionts do not return to produce oxygen, the corallite skeleton

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**Figure 6.1**
Ken + Julia Yonetani, *Dysbiotica – Pregnant Woman*, 2020. Porcelain clay, fiber-reinforced plastic, 38 × 18.5 × 18.5 in. Sesame Collection. Photography by Julia Yonetani. © Ken + Julia Yonetani. Courtesy of the Mizuma Art Gallery.

remains. Even as shared life histories separate, as a foundation species, this skeleton becomes architecture, not nothing.

Entangling coral, deer, and human skeletons, self-described "contemporary artist unit" Yonetani and Yonetani's *Dysbiotica* (2020) gathers a colony of forms. A seated antlered figure joins a pregnant form that evokes the *Venus of Willendorf*, and a collection of antlered deer heads is mounted as trophies on the wall. The deer, "a god of nature in Japan," sits in tension with the mounted trophy heads.[35] Dense masses of intricate and blindingly white ceramic forms accumulate to cover all surfaces; at times small and flat, and at other times more prominent and protruding, these could be bleached corals, but could also be microscopic ecological views of microbes. The artists invented the term "dysbiotica" from "dysbiosis," a disruption to microbiota, to evoke broader systemic disturbances across holobiont lifeworlds, including bleaching events on coral reefs. The surfaces vacillate between coral and microbe, finding formal permeability between body and environment.

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After moving to a depopulated "limited village" in Japan to expand their studio space, the Yonetanis found themselves living in a community of farmers and were inspired to cultivate the neglected land surrounding their new home. The soil required complete rehabilitation. Building the soil and improving the size and quality of crops took years. Recalling da Costa, Servan-Schreiber, and terrain, the Yonetanis found that "as the soil color and consistency changed, we noticed a change in ourselves too," because "the soil and our guts are not separate entities."[36] Ceramic materials link to the regenerated soil in their limited village and in turn to their microbiota. Soil, clay, and guts initiate a research project that extends to bleaching events on coral reefs and other mass die-offs, including pandemics. Although the work was already underway before COVID-19 was identified, *Dysbiotica* "questions the role humans have played in causing a systemic imbalance in the micro-world and our own microbiomes. The pandemic was a surprise and complete shock, but it also seems to fit in with this theme."[37] The work creates a formal and conceptual continuity between bleached coral, human bodies, sickness, and health.

"We are all lichens," declare Gilbert, Jan Sapp, and Alfred Tauber.[38] Haraway adds, "We are all lichens, all coral."[39] We are all lichens when we adopt a "symbiotic perspective," a "new paradigm for biology," and one that does away with biological individuality perceived through fractured senses in favor of understanding animals as "complexes of many species living together."[40] We are all holobionts. Our symbionts make us possible, while their absence, as with coral bleaching, makes us impossible. Being coral means acknowledging a shared life history and enmeshed community metabolism with countless species that are difficult to see and understand.

Would embodying shared life histories begin with something like identification with the figure of the holobiont? Cometabolism and symbiosis do not usually factor into questions of identification. Hayward considers limited human capacities to identify with aquatic invertebrates and the anthropocentric limits of empathetic bonds. She troubles cross-species affinity, questioning why "the organism can only receive the benefits of empathy if we can identify with it. This might work well for charismatic megafauna—dogs, horses, cats, dolphins—that we can map our bodies onto, but for jellies or coral or octopuses, the overwhelming bodily

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differences make identification a politics of erasure rather than empathy."[41] These overwhelming bodily differences, especially the facelessness of coral and lichen, thwart the body mapping Hayward describes: the dog and I both have legs, and the dolphin and I both have eyes. What can be done in such cases? How can bipedal people empathize with short-lived tentacular jellies or slowly extruding corals?

Despite differences between human, jelly, and coral bodies, we are "not without shared histories or consequences."[42] Life histories have material form and tangible, squishy effects. Sensing community metabolism through shared materials could facilitate if not identification, then sensory attunement between radically different life-forms. How can people expand their understanding of being to include corals? Ingestion helps. Reorienting again with Mol, shifting from body moving through world to world moving through the eating body creates an attunement between people and corals. Humanist vision would understand holobionts such as coral and lichen to be more or less stationary, receiving the world's water and nutrients.[43] A metabolic reading of worlds moving through bodies allows people to identify with corals through ingestion and nutrition. This reorientation expands concepts of being, departing from ableist ontologies that depend on autonomous, walking individuals and toward differently mobile or stationary collectivities.

Jellyfish, coral, and mammals are all bodies of water, even as water manifests and metabolizes differently for each. Hayward's politics of erasure might then put erasures of representationalism in conversation with a foregrounding of milieu or shared life materials and histories. Scholars Astrida Neimanis and Mielle Chandler trace watery connections to develop the possibility of "becoming milieu," a process that further disrupts notions of individuality and the sovereign subject: "Some of us might become milieu as womb, but we might also become milieu for multispecies ecologies in our guts."[44] Neimanis's bodies of water as well as Chandler and Neimanis's becoming milieu articulate the shared life histories that shape holobionts. The antlered and gestating figures of *Dysbiotica* have become milieu. Their forms enmesh with microbial and coral others.

Another possibility for attunement with corals arises from tactile approaches to understanding their hyperbolic geometry. Founded by

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sisters Margaret Wertheim and Christine Wertheim, the IFF works at the intersection of "the manifestation of figures in the world around us and the figurative technologies that humans have developed through the ages."[45] The IFF logo reads "Fig.," referencing the text beginning a caption in a figure embedded in science papers.[46] Fig. could shorten figuration.[47] A process of critical figuration aligns the IFF with Haraway's call to "resist representation" and Barad's call for "posthumanist performativity."[48] Recalling Myers's body experiments, the IFF's emphasis on "material play" signals that "ideas usually presented in abstract terms can often be embodied in physical activities."[49] Material play connects with aquatic species through crochet. From the French, *crochet*, "small hook," creates textiles from yarn, thread, or even soft plastic "plarn" with a single hook. The hook anchors each stitch before adding the next (versus knitting, which transfers stitches between two needles and keeps entire rows of stitches open at once). Crochet may not involve the sweeping gestures Myers observes among protein modelers, but crochet generates analogous shared embodied knowledge. As with protein modeling, crochet insists on three-dimensional kinetic processes for representing forms that are difficult to understand when reduced to static two-dimensional images.

In 2005, Wertheim and Wertheim began constructing the *Crochet Coral Reef*, the IFF's largest project, after Christine Wertheim read an article on coral bleaching. The sisters grew up in Queensland, Australia, in proximity to the Great Barrier Reef, the largest coral reef in the world. As Wertheim and Wertheim crocheted the first corals, "we joked to ourselves at the time that if this ecological treasure died out—an almost unthinkable notion then—our crochet reef would be something to remember it by. A decade later, scientists are warning such a scenario might not be impossible."[50] In the now nearly two decades since the *Crochet Coral Reef*'s first stitches, corals are in more peril than ever, and tens of thousands of crochet artists have contributed to the project.

Accelerating the perceived movement of "stationary" reefs to clock time, the "core collection" of reefs travel to international exhibitions, and as of 2022, fifty satellite reefs have been created by over twenty thousand people.[51] As coral habitats dwindle, the *Crochet Coral Reef* grows, working against forecasted futures that would characterize coral reefs as "zombie ecosystems, neither dead nor truly alive in any functional sense,

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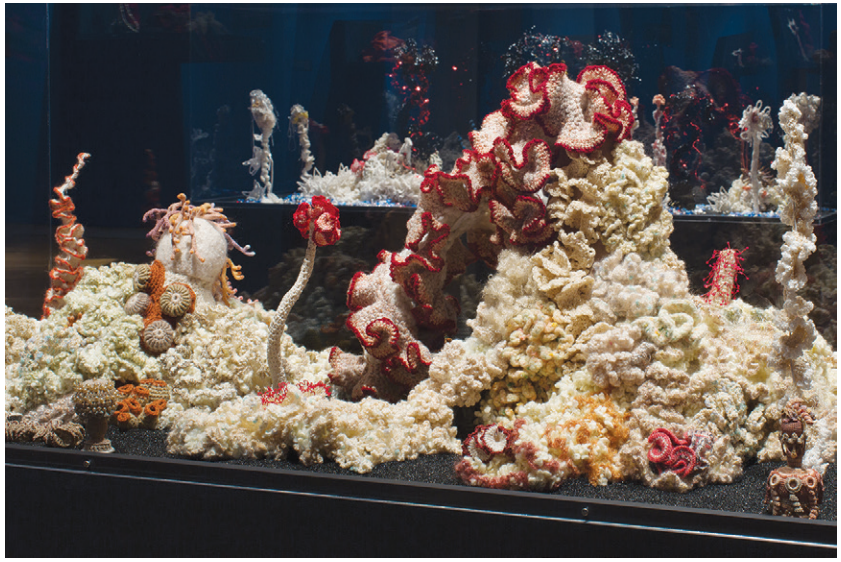

FIGURE 6.2
*Bleached Reef* by Christine and Margaret Wertheim and the Institute for Figuring at the Museum of Arts and Design, 2016. Photo credit: Jenna Bascom. Photo courtesy of MAD.

FIGURE 6.3
*Coral Forest* by Christine and Margaret Wertheim and the Institute for Figuring at Lehigh University Art Galleries, 2019. Photo credit: Stephanie Veto. Photo courtesy of LUAG.

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and on a trajectory to collapse within a human generation."[52] The *Crochet Coral Reef* claims and integrates bleaching and plastic pollution. Its vibrant forms suggest exuberant proliferation more than collapse. Holobionts straddle death and life boundaries easily; the architectural remains of bleached corals are a promise and a world. Scholar Scott East shows how "in moving beyond a literal representation of the future, these knots of various threads figure as engagements that specifically create worlds, rather than simply reflecting or representing."[53] The *Crochet Coral Reef* immerses visitors in the lifeworlds of precarious aquatic corals without claiming to stand in for or imitate them, sidestepping frameworks that would assume equivalence between such different embodiments.

The *Crochet Coral Reef* stages an excessive abundance of form, color, texture, and materials. Created from every possible type of yarn, incorporating plastic, discarded water bottles, and beads, many forms can be recognized as brain corals, sea cucumbers, anemones, kelp, and sea slugs, but other forms are improvisational departures from familiar reef creatures. Although displayed on land, their presentation conjures the underwater sensation that scholar Stefan Helmreich calls "immersion," what happens when people "submerge their bodies and eyes in the midst of coral communities."[54] *Crochet Coral Reef* exhibitions are often presented in dim rooms and lit from above. Hayward describes her immersed body of water as she visits the *Drifters* jellyfish exhibition at the Monterey Bay Aquarium: "Immersed in this liquid light and aurally wet space, in my flesh, I imagine myself breathing in water."[55] Visitors drift among the reefs as if swimming, weightless, and buoyant, perhaps sharing Hayward's sensation of breathing in water. Breathing with corals in water suggests metabolic sympathy: taking in nourishment in the way that corals receive it.

At first, the Wertheims crocheted with strict adherence to the N+1 formula developed by mathematician Daina Taimina, who found that crochet effectively models hyperbolic geometry.[56] The non-Euclidean geometry of the hyperbolic plane forms from negative curvature versus the positive curvature of a sphere. Sea creatures utilize hyperbolic shapes to maximize surface area, increasing their contact with nutrient and oxygen flows in the water. Mammalian intestines do the same thing, looping, spiraling, and folding to better absorb nutrients. Worldly hyperbolic spaces are messy and more complex than crocheting N+1. The *Crochet*

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*Coral Reef*'s irregular forms "swerve away from mathematical perfection."[57] Margaret Wertheim describes "the emergence of a fantastical taxonomy of crochet reef 'species.'"[58] The reef evolves.

The nested collectivities that form the crocheted reef resemble the shared life histories and community metabolisms of holobiont corals themselves. Each of the core collection reefs was made collectively, and each satellite reef forms a linked holobiont sponsored by or nested within further collective structures. Reefs share life history, hooking one craft or institutional collective to another, as with the *People's Reef*, a combination of the *Chicago Satellite Reef*, *Scottsdale Satellite Reef*, and *New York Satellite Reef*, or the *Sydney Satellite Reef*, which was hosted by the In Stitches art collective and exhibited at the Powerhouse Museum.

Collectivity materializes time, for the reef causes visitors "to feel the crystallization of human time," specifically women's time.[59] *Satellite Reef* coordinator Anna Mayer observes how the *Crochet Coral Reef* "has become a vehicle for presenting thousands of relatively anonymous women and their work within prestigious institutions."[60] Anonymous collective labor, holobiont labor, intrudes on museum and gallery spaces that historically have preferred to celebrate the accomplishments of individual (white male) artists. The forms create collectivity while the activities surrounding the forms metabolically transform and change corals, reefs, and configurations. Collective patterning elaborates on Taimina's N+1 crochet formula; collective materials evolve, such as "spinning" plastic yarn or plarn; and moundification curates and joins the crocheted corals together as they are piled and arranged on top of a substructure made of cardboard tubing and chicken wire.[61] Work, materials, communities, and forms nest within one another, giving the reef project characteristics ascribed to holobionts: shared life histories, cometabolism of communal resources, and persistent communities through generations.

The women who crochet the reef share methods with the corals themselves to become "mathematicians-by-practice"—a becoming that could be likened to becoming holobiont. Margaret Wertheim explains that "sea slugs and electrons, and many other modest natural systems, are engaged in what we might call the performance of mathematics. Rather than *thinking* about maths, they are *doing* it."[62] Crochet creates senses in common with marine creatures that are difficult to identify with and at times

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difficult to see. Accessing the hyperbolic plane with crochet overcomes barriers to identification and empathy by linking "doing mathematics" with "becoming coral." Doing mathematics becomes a process of rendering, in Myer's sense, a collective performance that transmits knowledge across bodies and species. The *Crochet Coral Reef* uses fingers and hooks to transform crocheting bodies into coral bodies. This metabolic reading troubles body process and body boundaries to construct a shared holobiont milieu. We are all coral.

## We Are All Lichens

Lichens have slowly but determinedly anchored into and covered contemporary art practices. Poster life-forms for symbiosis, lichens are fungus and algae sharing space and life history. Lichens are often defined by what they are not. Lichens are not mosses. Even though mosses and lichens might cling to rocks and superficially resemble one another, mosses are plants with roots, leaves, and stems. Although lichens' algae are plants and will photosynthesize if positioned closer to sunlight, without roots, leaves, or stems, lichens are not plants. Lichens are not even "fungus plus algae"; detecting the presence of yeasts in addition to previously known fungi and algae make lichens a symbiosis between not two but three partners.[63] Lichens are as diverse and difficult to describe as corals, with exceptions to every rule. Witch's hair (*Alectoria sarmentosa*) resembles long, full green braids draping from tree branches. Crust lichens cling to rocks, adding brilliant yellow, orange, red, and green flashes. Reindeer moss (*Cladina arbuscula*) resembles clusters of reindeer antlers and can be found on the surface of bogs and exposed heath. Over seventeen thousand lichen species have been identified around the world. As the US Department of Agriculture's Forest Service Lichen web page reminds us, "Those are just the ones we know about!"[64]

Palmer's *The Lichen Museum* develops a walking and lichen appreciation program designed to shift participants into lichen time and assert lichen politics. At first, Palmer conceived of *The Lichen Museum* as a brick-and-mortar structure with exhibits and artifacts devoted to lichens. She quickly realized that lichens would not cooperate with this effort to contain or curate them. Lichens are "this thing that can't be collected, gathered,

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**Figure 6.4**
A. Laurie Palmer, *The Lichen Museum*, 2015. Photographic documentation of public art project. Courtesy of A. Laurie Palmer.

contained, stored, hoarded. . . . [T]hey need to be left in place, and watched in place—and in watching, you might form a curious alliance." In Edinburgh, Palmer learned that there were no lichens in the gardens until the air quality improved following factory closures. Because lichens choose when and where to appear, "lichen" and "museum" sit beside one another in productive tension. When Palmer visited lichenologist Rebecca Yahr at the Royal Botanic Gardens in Edinburgh, she toured the lichens "in the collection." But the lichens were not collected in any traditional sense. Lichens "in the collection" are those that happen to exist within the gardens. They are there "purely by accident—by their intention, not the gardeners'. You can't make a lichen do anything it doesn't want to do."[65] People nonetheless act in ways that can benefit or harm lichens.

*The Lichen Museum* hosted a *Lichen Walk* series at the Headlands Center for the Arts in 2014. Documentation from the walks shows museumgoers bending over to closely inspect the lichens inhabiting the rocky hills of the Marin Headlands in California. Inches away from the living surface of the rocks, their faces and postures recall aquatic immersion into coral

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habitats and the effort to "submerge bodies and eyes."[66] The eyes embrace the lichens, bringing vision inside the skin and closing the distance that makes vision seemingly objective. Lichen walks encourage slowness: "Watching lichen for an afternoon might slow us down to a metabolic rate more responsive than our daily rhythms to imagining time frames of planetary change, and how humans are affecting them."[67] The slow walk evokes the slow pace of lichen growth, despite and because of the impossibility of walking as slowly as lichens grow (sometimes millimeters per year). Lichen growth rates have emerged as valuable indicators of climate change impacts, resonating with Palmer's call to link body, lichen, and planetary metabolisms.[68] Although a few hours of walking could not slow a person's metabolism, metabolism's common sensible and cultural capacities attune bodies across time and species to precipitate awareness of a shared milieu.

Attunement with lichens has political effects. Palmer's lichen manifesto lists "5 radical qualities of lichens we can learn from":

1. Collectivity
2. Their site specificity
3. Their slow pace, their long-term perspective
4. Their refusal to be commodified or used as resource and supply
5. Their connection to thingliness: a continuum between . . . living and nonliving matter[69]

These characteristics of lichens model how to be in the world. Even though lichens have been harvested for dyes, perfumes, food, and medicines, they "are anti-capitalist because you can't translate their vegetal being or their vital forces into money. Lichen successfully resist human manipulation and exploitation."[70] This resistance extends from anticapitalism to representationalism. Holobionts are difficult to see, and lichens share the radical otherness found in the corals and marine invertebrates Hayward works to identify with. As with the *Crochet Coral Reef*, efforts to understand lichens should start with lichens, not people. The body mapping that might work for megafauna (my legs help me understand dogs, who also have legs) reverses, with lichens leading. The lichen and I both exist in time. How might my pace and metabolic sensations slow to attune with lichen pace and metabolisms?

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Although lichen are not animals (nor plants, fungi, or algae), their collectivity recalls my work with Hayward developing "tranimals," a portmanteau word that "plays with the prefix 'trans' as a plurality—as in animals—to suggest the ongoing labour of cross-species agents. Trans suggests the energetic and material crossings that disrupt bifurcated categories."[71] Lichens inhabit these same crossings, refusing categorization and embracing plurality. Lichens reveal "our seeming incapacity as humans to deal with collective identities," interfering with grammar as "it / they are / is neither singular nor plural" just as lichens are neither fungus nor alga.[72] Collectivity upsets binary oppositions; the struggle to find a grammar for lichens aligns with efforts to shift from gendered (she/her, he/his) to collective and inclusive pronouns (they/them). They/them would be the most appropriate pronouns for holobionts of all kinds.

*The Lichen Museum* refuses to represent lichens. They grow in places that nourish them, and moving or rearranging them could kill them. Although lichens might be photographed, drawn, or embroidered, their site specificity complicates representation. Lichens enter image worlds with the understanding that "being there" matters, recalling debates about the status of documentation for time-based and performance art.[73] An image of a lichen cannot capture the microclimate, minerals, and air that make the lichen possible. *The Lichen Museum* focuses on immersive activities such as slow walks so that museum visitors can anchor themselves in the shared environmental conditions that sustain both lichens and people. The slowness and immersive embodiment of Palmer's walks allow lichen worlds to lead by moving through multispecies bodies.

Carlson's *We Are all Lichen* (2019) shares Palmer's emphasis on the slow pace of lichen lives. Embroidery covers fabric panels, with the thread engaging its fabric surface much as lichens engage rocks, attaching with filament rhizomes or a central holdfast. As with the *Crochet Coral Reef*, the embroidered panels record and juxtapose the slow time of craft beside the slow time of lichens. Embroidery's process of covering a surface with a combination of anchoring and surface embellishment emulates the growth and structure of many lichen species. When Carlson visited Sydney in 2019, they were finalizing the panels for an exhibition. Attempts to speed up a slow craft project about slow lichens were not without irony. The solution, appropriately, was collectivity. Enlisting as many

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FIGURE 6.5
A work-in-progress photo of Bug Carlson's *We Are all Lichen: Toward a Resurgent Symbiosis*. Photo credit: Lindsay Kelley. Courtesy of the artist.

fellow embroiderers as possible allowed the project to grow, still slowly but less slowly than when Carlson was crafting alone. An artist's book accompanies the tapestries, mingling poetry, prose, and essay formats to ruminate on Gilbert, Sapp, and Tauber's declaration that "we are all lichen."[74] Carlson undertakes projects such as *We Are all Lichen* and their creative performance research on endangered freshwater mussels, *Becoming Benthic* (2019), to understand themselves as holobiont. They promote holobiont embodiment as an experiential identity-making process that becomes a political strategy for social justice across species, and their plural pronouns are linked to and inspired by this holobiont identity.

Founded in 2018 by Zettel and Sivanesan, *The T. Rudzinskaitė Memorial Amateur Lichenologists Society* follows lichens to merge speculative storytelling with real holobiont and researcher lives. In conversation with Palmer, Zettel and Sivanesan ask, "What can we learn from Lichen about co-becoming as survivance and collective (self-)care in an era of toxicity

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and mass extinctions?"[75] Teklė Rudzinskaitė (1927–1994) was a Lithuanian lichenologist whose collection of over fifteen hundred specimens has been preserved in the herbarium of Vilnius University.[76] Zettel and Sivanesan's work with Rudzinskaitė's archive recalls artist Kathy High and scholar Guy Schaffer's speculative historical scatologist, Challis Underdue, who appears in chapter 5 as a threshold figure, born when waste was a resource and living through the industrial era that birthed the concept of metabolism. Rudzinskaitė and Underdue are both path-breaking and underappreciated women in science and are also known primarily through the archives they left behind. Rudzinskaitė is a real person, but Zettel and Sivanesan shift her legacy into creative fabulation by setting the work of *The T. Rudzinskaitė Memorial Amateur Lichenologists Society* seventy years in the future. In 2088, on the occasion of the society's annual field trip and picnic, humanity had survived "the Great Derangement," characterized by "the mass die-off of species, rampant state corp surveillance and cycles of repressions and uprisings that continued into the New Dark Ages, . . . desperate decades when the Society was forced underground along with other groups fighting for slow horizontal solidarities and more than human kinship."[77] By locating the project in the future, after the Great Derangement but after the "ecosexual revolution" too, Zettel and Sivanesan claim the inevitable success of their and other sympathetic projects. These "other groups fighting for slow horizontal solidarities" might include the IFF's *Crochet Coral Reef*, Palmer's *Lichen Museum*, Carlson's embroidered holobiont activisms, and artists Annie Sprinkle and Beth Stephens and scholar Jennie Klein's ecosexual manifesto, a likely contribution to the near-future "ecosexual revolution."[78] Declaring that a present-day event such as the society field trip and picnic takes place seventy years in the future both affirms the possibility of that future and takes inspiration from the life cycles of lichens, some species of which grow only one to two millimeters per year, and so may have passed this tumultuous span of clock time comparatively unchanged.

*The T. Rudzinskaitė Memorial Amateur Lichenologists Society* field trip and picnic stages a lichen-spotting walk punctuated by food, drink, and short rituals. Toward the end of the event, participants "deposit[ed] a rock we had brought along from the sea into a sacrificial pot in the sand,

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in a kind of offering to lichen, a 'thank you' for the slow, hard work of metabolising stone, of turning nonlife into life through the air that we share, despite the toxicities now becoming-with alongside and inside us all."[79] This act of feeding the lichens at an event with ample opportunity for feeding people recalls Palmer's proposition that metabolism facilitates attunement with lichens. Lichen research-creation calls on metabolism to mobilize common sensation, bringing radically different embodiments into relation through eating, digesting, and transforming food. Even if a visually intuitive anthropocentric body-mapping identification process remains elusive, these works show that common senses are possible.

## Holons within Holons

Sutela, whose *Wet-on-Wet* animated the molecule ATP considered in chapter 4, created the video *Holobiont* (2018) to experience and track the spore-forming extremophile bacterium *Bacillus subtilis*. *B. subtilis* have traveled to space to test the likelihood of unintentionally contaminating extraterrestrial sites with Earth bacteria. One experiment exposed *B. subtilis* to outer space on the International Space Station and in a simulated Martian environment.[80] Researchers found that if shielded from ultraviolet radiation, *B. subtilis* survive well, even in space: enough spores survived that they could potentially contaminate an extraterrestrial destination. While this might be bad news for planetary protection, at least space travelers will be able to eat nattō for breakfast. Made from fermented soybeans, *B. subtilis nattō* gives nattō its sticky, stringy texture and probiotic benefits. *B. subtilis* also occurs in the gastrointestinal tracts of many species, from mammals to marine sponges.

Sutela's *Holobiont* follows *B. subtilis* from nattō to guts to Mars and back again. Narrated by an ethereal "voice of gut," astrobiological seeds are sown across scenes of nattō preparation, nattō consumption and material experimentation, Mars rover embodiment, and Planetary Protection laboratories at the European Space Agency. Nattō scenes are infused with cool, otherworldly violet light—the same light that sterilizes equipment in the Planetary Protection laboratory. Nattō persists, becoming extravagant under this light. Pulled from hand to mouth and around the body, an egg arises in one moment, and a goopy and slimy extension

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of nattō's string figures the next. Laboratory scenes follow efforts to use instruments installed on a rover to detect extraterrestrial life after determining that microbe-bearing dust will not contaminate the detection equipment. Links between bodies and rovers broaden to recast bodies as "earth rovers." Recipient sensors carry seeds or eggs to other worlds. A companion video, *nimiia cétiï* (2018), gives voice to *B. subtilis* by using neural networks to generate new sounds and scripts from two primary inputs, the movement of *B. subtilis* and a recording of Sutela speaking a Martian language channeled by late nineteenth-century French medium Hélène Smith.

Referencing author Ursula K. Le Guin's "Carrier Bag Theory of Fiction," Sutela's *Holobiont* frames "the human body as this carrier bag for bacteria, babies, germs, and parasites" as well as "a tool for an embodied social commons."[81] Nattō bridges carrier bag and social activation. Holobiont continuity interrupts the birth of individuals, generations, and worlds that characterize colonial space conquest narratives. Like many fermented foods, nattō is hard to hold. Sutela demonstrates this with her nattō body extension choreography across person, machine, and fermented egg. Fermented foods require vessels, and these vessels distribute digestion across time and space. Le Guin imagines ancestors figuring out how to hold onto food and distribute their digestive organs amid the collective technosocial activities of eating and parenting:

> If you haven't got something to put it in, food will escape you—even something as uncombative and unresourceful as an oat. You put as many as you can into your stomach while they are handy, that being the primary container; but what about tomorrow morning when you wake up and it's cold and raining and wouldn't it be good to have just a few handfuls of oats to chew on, . . . but how do you get more than one stomachful and one handful home? So you get up and go to the damned soggy oat patch in the rain, and wouldn't it be a good thing if you had something to put Baby Oo Oo in so that you could pick the oats with both hands? A leaf a gourd a shell a net a bag a sling a sack a bottle a pot a box a container. A holder. A recipient.[82]

The first recipients are the hands, mouth, and stomach. Sutela's carrier bag holobiont passes an unruly, stringy handful of nattō from one hand to the other, and then transfers still unruly and still stringy nattō from

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hand to mouth. The womb carried the baby before the sling; the mouth, stomach, and hands carried the oats before the bag. Metabolic cycles and a search for homeostasis animate Le Guin's interpretation of anthropologist Elizabeth Fisher's carrier bag theory of human evolution: "With or before the tool that forces energy outward, we made the tool that brings energy home."[83] Bodies model the carrier bags that will evolve alongside the weapon.

In the multispecies view that Sutela brings to *Holobiont*, body sensors learn from carrier bag technologies to become "cultural devices" capable of gathering, dispersing, or containing their contents across more-than-human and more-than-Earth galaxies.[84] The first carrier bags were modeled on bodies, and carrier bag technologies have in turn influenced and changed how bodies are understood. What contained life on Earth, or perhaps brought life from other planets? And how can body-sensor-carrier-bags influence the containment of Earth life returning to space?

Michael Burton's *Astronomical Bodies*, a proposal for creating meteorites to facilitate interplanetary phosphorus seeding (discussed in chapter 4), could be interpreted as "directed panspermia," or the intentional effort to seed other planets with Earth life-forms. Sutela prefers the work of planetary protection. She frames such work "as a ritual to get rid of ourselves and let different life on other planets to develop in peace." To "get rid of ourselves," our carrier bags must be more sealed than leaky, be they bodies, rovers, or planets. As Sutela cautions, "Life is already connected. If the conditions are right, anything could turn into nattō."[85] The holobiont's expansiveness and connectedness sit in tension with the cleaning and sterilizing rituals of the planetary protection researchers.

A chanted refrain punctuates the *Holobiont* video: "holons within holons within holons." Sutela follows author Arthur Koestler's definition for "holon" in *The Ghost in the Machine*: that which is both a part and a whole.[86] Parts and wholes, parts that make wholes, and seeming wholes that are parts of bigger and always partial wholes; this constant churn and scale shifting make holobionts multidimensional giant creatures. Process-driven metabolic readings of parts and wholes disrupt representation and the represented. Scholar Caroline Jones could be referencing holobionts and the difficulties of modeling the small, slow, and radically other when she writes, "The ultimate act of modeling, . . . is to collaborate

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on the common sense."[87] Holobionts dwell in the space that shared sensory knowledge creates.

Holobionts encourage metabolic and negotiated reading practices, and resist or reject easy understandings of representationalism. And yet at the end of this tour through coral reefs, lichen-covered rocks, and alien nattō, seeing holobionts may never be possible, and seeing holobionts may not matter as a project. Together, the feminist, queer, bioart, installation, and performance projects assembled here, in *After Eating*, expand the sensory capacities of shared metabolic materials up to and beyond the point of failure. These failures return us to Hird and Clark's reminder, quoted earlier, that understanding "a vast meshwork of interacting bacteria, is . . . beyond our grasp." If knowing, seeing, or being holobionts remains elusive, this elusiveness creates conditions for stretching and grasping toward a growing collective sensorium. Inheritors of five senses may slowly but perceptibly metabolize holobiont possibilities.

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# Notes

## Introduction

1. In the last decade, so many exhibitions have centered food and participatory formats that keeping track of them all or tracing a genealogy becomes difficult. *Feast: Radical Hospitality in Contemporary Art* was curated by Stephanie Smith at the Smart Museum of Art at the University of Chicago in 2012, *EAT ME* was curated by Karen Grøn at the Trapholt Museum of Modern Art and Design in 2017–2018, and Artback NT toured *We Eat We Are* curated by Sarah Pirrie across the Northern Territory in Australia in 2019–2020, to name just three.

2. Participatory art, social practice, and what art historian Claire Bishop calls "the social turn" each name the impulse to actively engage people in artworks as participants instead of passive observers. For Bishop, a work is "participatory" if "people constitute the central artistic medium and material." Claire Bishop, *Artificial Hells: Participatory Art and the Politics of Spectatorship* (London: Verso, 2012), 2. See also Claire Bishop, "The Social Turn: Collaboration and Its Discontents," *Artforum*, February 2006.

3. There are many metabolisms, adding fleshy weight to historian Douglas Kahn's proposition that "it is better to talk about energies, in the plural, rather than energy." Douglas Kahn, introduction to *Energies in the Arts*, ed. Douglas Kahn (Cambridge, MA: MIT Press, 2019), 1.

4. Myra Hird extends metabolism to the nonliving and inorganic, operating at a planetary scale, for "we could equally discuss how hurricanes metabolize wind, currents, air, temperature." Myra Hird, "Digesting Difference: Metabolism and the Question of Sexual Difference," *Configurations* 20, no. 3 (2012): 235.

5. I have chosen not to reproduce stills from *Mutaflor* because when stopped, the installation loses too much. Pausing for stills arrests the flow and looping I follow and abandons Rist's commitment to installations that call on video bodies to pull the bodies of visitors into unexpected formations. *Mutaflor* can be accessed online: Berliner Künstlerprogramm, "50 out of 1000: Pipilotti Rist," Vimeo, November 18,

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2018, https://vimeo.com/79680132. A grid of stills that (unusually) include the anus can be found in Natasha Bullock, *Pipilotti Rist: Sip My Ocean* (Sydney: Museum of Contemporary Art Australia, 2018), 140.

6. My first book focused on intersections between laboratory, kitchen, and art studio. Lindsay Kelley, *Bioart Kitchen: Art, Feminism and Technoscience* (London: I. B. Tauris, 2016).

7. Pipilotti Rist, "I Rist, You Rist, She Rists, He Rists, We Rist, You Rist, They Rist, Tourist: Hans Ulrich Obrist in Conversation with Pipilotti Rist," in *Pipilotti Rist*, ed. Peggy Phelan, Hans Ulrich Obrist, and Elisabeth Bronfen (New York: Phaidon, 2001), 17.

8. Ahmed's description of her "killjoy survival kit" has flavored my reading of her writing. I always think of chili because in her kit, she "would have a bag of fresh chilies; I tend to add chilies to most things . . . you would have in your kit whatever you tend to add to things; however you adapt dishes to your own requirements." Sara Ahmed, *Living a Feminist Life* (Durham, NC: Duke University Press, 2017), 247.

9. Ahmed, *Living a Feminist Life*, 37.

10. Lynn Margulis, "Symbiogenesis and Symbionticism," in *Symbiosis as a Source of Evolutionary Innovation: Speciation and Morphogenesis*, ed. Lynn Margulis and René Fester (Cambridge, MA: MIT Press, 1991), 1–14.

11. Hannah Landecker, "Postindustrial Metabolism: Fat Knowledge," *Public Culture* 25, no. 3 (2013): 495.

12. Here, "apparatus" resonates with Karen Barad's work on experimental apparatuses in physics. Karen Barad, *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning* (Durham, NC: Duke University Press, 2007).

13. I am thinking of scholar Lucy Suchman's difference between planning and situated acting. Lucy Suchman, *Plans and Situated Actions: The Problem of Human-Machine Communication* (Cambridge: Cambridge University Press, 1987).

14. "Roche Biochemical Pathways," Roche, 2014, https://www.roche.com/about/philanthropy/science-education/biochemical-pathways/. To indicate the breadth and complexity of metabolic pathway research, the MetaCyc database, updated in 2020, contains "2749 pathways derived from more than 60,000 publications." Ron Caspi et al., "The MetaCyc Database of Metabolic Pathways and Enzymes—a 2019 Update," *Nucleic Acids Research* 48, no. D1 (2020): D445–D453.

15. Peggy Phelan, "Opening Up Spaces within Spaces: The Expansive Art of Pipilotti Rist," in *Pipilotti Rist*, ed. Peggy Phelan, Hans Ulrich Obrist, and Elisabeth Bronfen (New York: Phaidon, 2001), 34.

16. Grounded theory is a big place. PJ Macleod's work on feminist research into pornography consumption offers a concise summary of overlaps between grounded

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theory and feminist concerns, and then suggests how "grounded theory approaches conventionally employed for the purpose of achieving *ideological* goals around objectivity, neutrality and the quest for a singular truth, may be repurposed in pursuit of *empirical goals* around avoiding agenda-driven outcomes and generating new conceptual discussions." In the case of *Mutaflor*, the pornographic hovers at the edges of the video, with nudity, posture, and camera angles making the video "kinda porny," as a student remarked in class. And yet, the ground itself resists easy categorization, with its citrus, croissants, and rough floorboards distracting from the naked woman, preventing only one reading. PJ Macleod, "Tackling Polarity: Repurposing Grounded Theory in Feminist Research," *Qualitative Research in Psychology* 19, no. 2 (April 3, 2022): 565–580, https://doi.org/10.1080/14780887.2020.1725946.

17. Hannah Landecker, "Food as Exposure: Nutritional Epigenetics and the New Metabolism," *BioSocieties* (2011): 167–194.

18. Landecker, "Postindustrial Metabolism."

19. Hannah Landecker, "Metabolism, Reproduction, and the Aftermath of Categories," *S&F Online* 11, no. 3 (2013), https://sfonline.barnard.edu/metabolism-reproduction-and-the-aftermath-of-categories/.

20. Annemarie Mol, *Eating in Theory* (Durham, NC: Duke University Press, 2021), 138.

21. Danielle Wilde, "Shitty Food-Based World-Making: Recasting Human|Microbiome Relationships beyond Shame and Taboo," *Futures* 136 (2022): 102853, https://doi.org/10.1016/j.futures.2021.102853.

22. Daniel Max Gerling, "Excrementalisms: Revaluing What We Have Only Ever Known as Waste," *Food, Culture and Society* 22 (2019): 622–638; MIT Senseable City Laboratory, *The Underworlds Book* (Cambridge: Massachusetts Institute of Technology, 2019); Guy Schaffer, "The History of Shit—the Forgotten Scatomancer: Challis Underdue's Excremental Vitality and the *Medical Cultures of Modern Great Britain*," You Are My Future, 2017, https://www.youaremyfuture.com/challis-underdue; Myra Hird and Nigel Clark, "Deep Shit," *O-Zone: A Journal of Object-Oriented Studies*, no. 1 (2013): 44–51; Dominique Laporte, *History of Shit*, trans. Rodolphe el-Khoury and Nadia Benabid (Cambridge, MA: MIT Press, 2000).

23. Mol, *Eating in Theory*, 25.

24. Donna Haraway, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," *Feminist Studies* 14, no. 3 (1988): 575–599.

25. Cariou draws on First Nations knowledge to develop "energy intimacy" as an alternative to the extractive systemization of life: "Every community member necessarily has direct and personal relationships with the sources of their energy. . . . [I]n Aboriginal cultures, this relationship is not one of mastery or objectification but rather of kinship, respect, and responsibility," which "results in a conception

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of energy fundamentally different from today's prevailing Western ideologies of energy extraction, commodification, and ownership." Warren Cariou, "Aboriginal," in *Fueling Culture: 101 Words for Energy and Environment*, ed. Imre Szeman (New York: Fordham University Press, 2017), 18. Gómez-Barris reminds me that extractive zones are not places people live so much as structures that ensnare entire lifeworlds: "The 'extractive zone' names the violence that capitalism does to reduce, constrain, and convert life into commodities, as well as the epistemological violence of training our academic vision to reduce life to systems." Macarena Gómez-Barris, *The Extractive Zone: Social Ecologies and Decolonial Perspectives* (Durham, NC: Duke University Press, 2017), 116, xix.

26. Heather Davis and Zoe Todd, "On the Importance of a Date, or Decolonizing the Anthropocene," *ACME: An International Journal for Critical Geographies* 16, no. 4 (2017): 761–780.

27. Eva Haifa Giraud has explicitly asked, "'What comes after entanglement?' . . . not to deny the entangled complexity of the world, . . . but to explore the possibilities for action amid and despite this complexity." Eva Haifa Giraud, *What Comes after Entanglement? Activism, Anthropocentrism, and an Ethics of Exclusion* (Durham, NC: Duke University Press, 2019), 2.

28. Alexis Shotwell, "Flourishing Is Mutual: Relational Ontologies, Mutual Aid, and Eating," *Feminist Philosophy Quarterly* 7, no. 3 (2021): 2.

29. Andrew Pickering, *The Mangle of Practice: Time, Agency, and Science* (Chicago: University of Chicago Press, 1995); Joseph Dumit, "Writing the Implosion: Teaching the World One Thing at a Time," *Cultural Anthropology* 29, no. 2 (2014): 344–362.

30. I use "art" and "research-creation" interchangeably with the understanding that all art is research, and that all research carries varying levels of depth and multidisciplinarity. In the Canadian context, research-creation might be funded through grant monies that may not be accessible to all art practices. Stephanie Springgay, "Research-Creation," Pedagogical Impulse, accessed January 20, 2022, https://thepedagogicalimpulse.com/research-methodologies/.

31. Artistic approaches that knot together theory and practice contribute more broadly to Loveless's mobilization of research-creation as what might "impact our social and material conditions, not by offering more facts, differently figured, but by finding ways, through aesthetic encounters and events, to persuade us to care and to care differently." Natalie Loveless, *How to Make Art at the End of the World: A Manifesto for Research-Creation* (Durham, NC: Duke University Press, 2019), 101, 107.

32. Kat Jungnickel, "Making Things to Make Sense of Things: DIY as Practice and Research," in *The Routledge Companion to Media Studies and Digital Humanities*, ed. Jentery Sayers (London: Routledge, 2018), 492–502.

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33. More than a topic, metabolism functions as a method for artists and designers. Marc Tuters and Denisa Kera replace "human-computer interaction" with "metabolism interaction" to "offer the concept of metabolism as a model of how to design for multi-scalar interactions from the genetic to the planetary (from farm to fork to phenotype)." Marc Tuters and Denisa Kera, "Hungry for Data: Metabolic Interaction from Farm to Fork to Phenotype," in *Eat, Cook, Grow: Mixing Human-Computer Interactions with Human-Food Interactions*, ed. Jaz Hee-jeong Choi, Marcus Foth, and Greg Hearn (Cambridge, MA: MIT Press, 2014), 243.

34. Writing about Milpirri, "a greater sensory teaching" that is also "the experimental Warlpiri ceremony produced in conjunction with Tracks Dance Company since 2005" in Australia, Steven Wanta Jampijinpa Patrick and Jennifer Biddle argue that by attending to otherwise marginalized embodied knowledge, "memories of the senses" play a crucial role in what collectively "bind[s] people to place through practice." Steven Wanta Jampijinpa Patrick and Jennifer Biddle, "Not Just Ceremony, Not Just Dance, Not Just Idea: Milpirri as Hyperrealism, a Key Word Discussion," *Visual Anthropology Review* 34, no. 1 (2018): 27–35, https://doi.org/10.1111/var.12150.

35. For more on home economics as insurgent feminist science, see Kelley, *Bioart Kitchen*.

36. Jennifer Ponce de León offers a genealogy for common sense by way of Antonio Gramsci's replacement of "'common sense' (*senso comune*) with 'good sense' (*buon senso*)." Ponce de León's metabolic reading argues that Gramsci "was referring not only to the transformation of theoretical knowledge, but also to perception and practical knowledge." Transformation renders vocabularies as pathways, loops, and spirals, but common sense continues to be aligned with the status quo and "unquestionable." Jennifer Ponce de León, *Another Aesthetics Is Possible: Arts of Rebellion in the Fourth World War* (Durham, NC: Duke University Press, 2021), 7, 95.

37. David Howes and Constance Classen, *Ways of Sensing: Understanding the Senses in Society* (New York: Routledge, 2014), 171.

38. Carolyn Korsmeyer summarizes the logic behind this: "Sight and hearing operate with a distance between object and organ of perception. . . . The senses of taste, touch, and smell, in contrast, are experienced as 'in' the body, locatable in the fingertips, the mouth, the olfactory passages." Carolyn Korsmeyer, *Making Sense of Taste: Food and Philosophy* (Ithaca, NY: Cornell University Press, 2002), 24–25.

39. Aristotle quoted in Korsmeyer, *Making Sense of Taste*, 19; A. D. Craig, "How Do You Feel? Interoception: The Sense of the Physiological Condition of the Body," *Nature Reviews: Neuroscience* 3 (2002): 655. For an expert engagement with "crossmodal" practice across sensory studies and art practice, see Joanna Burzynska, "Tuning Sensory Terroir: Mapping Correspondences between Sound and Wine in a Crossmodal Art Practice" (PhD diss., University of New South Wales, 2020), http://hdl.handle.net/1959.4/70675.

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40. Nick Estes and Jaskiran Dhillon, eds., *Standing with Standing Rock: Voices from the #NoDAPL Movement* (Minneapolis: University of Minnesota Press, 2019); Zoe Todd, "Indigenizing the Anthropocene," in *Art in the Anthropocene: Encounters among Aesthetics, Politics, Environments and Epistemologies*, ed. Heather Davis and Etienne Turpin (London: Open Humanities Press, 2014), 241–254; Donna Haraway et al., "Anthropologists Are Talking—About the Anthropocene," *Ethnos Journal of Anthropology* 81, no. 3 (2016): 535–564; Donna Haraway, "Anthropocene, Capitalocene, Plantationocene, Chthulucene: Making Kin," *Environmental Humanities* 6, no. 1 (2015): 159–165; Janae Davis et al., "Anthropocene, Capitalocene, . . . Plantationocene? A Manifesto for Ecological Justice in an Age of Global Crises," *Geography Compass* 13, no. 5 (May 2019), https://doi.org/10.1111/gec3.12438.

41. For more about food art, see, among countless other references, Silvia Botinelli and Margherita d'Ayala Valva, eds., *The Taste of Art: Cooking, Food, and Counterculture in Contemporary Practices* (Fayetteville: University of Arkansas Press, 2017); Zane Cerpina and Stahl Stenslie, *The Anthropocene Cookbook: Recipes and Opportunities for Future Catastrophes* (Cambridge, MA: MIT Press, 2022); Megan Fizell, "Gastronomic Body: Sensory and Sociocultural Dimensions of Food Art" (PhD diss., University of New South Wales, 2021), http://handle.unsw.edu.au/1959.4/71157; Kelley, *Bioart Kitchen*; Stephanie Smith, ed., *Feast: Radical Hospitality in Contemporary Art* (Chicago: University of Chicago Press, 2013); Nicole Woods, "Taste Economies: Alison Knowles, Gordon Matta-Clark and the Intersection of Food, Time and Performance," *Performance Research* 19, no. 3 (2014): 157–161.

42. Craig, "How Do You Feel?," 655; Erik Ceunen, Johan Vlaeyen, and Ilse Van Diest, "On the Origin of Interoception," *Frontiers in Psychology* 7, no. 743 (2016).

43. David Robinson and G. F. Gebhart, "Inside Information: The Unique Features of Visceral Sensation," *Molecular Interventions* 8, no. 5 (2008): 242–253.

44. Ulrich Sonnenborn, "Escherichia Coli Strain Nissle 1917—from Bench to Bedside and Back: History of a Special Escherichia Coli Strain with Probiotic Properties," *FEMS Microbiology Letters* 363, no. 19 (2016): fnw212.

45. Carolee Schneemann, *Uncollected Texts*, ed. Branden Joseph (Brooklyn, NY: Primary Information, 2018), 115.

46. Barbara Montero, "Proprioception as an Aesthetic Sense," *Journal of Aesthetics and Art Criticism* 64, no. 2 (2006): 240. Erin Manning might consider Montero's dancers and audiences to be together in "a thinking that composes-with movement, with-body-in-the-making." Erin Manning, *Always More Than One: Individuation's Dance* (Durham, NC: Duke University Press, 2013), 14.

47. Adapted from "Alexander von Baumgarten's original definition of the term aesthetic as occupying the space between raw sensation and abstract cognition." Michael Bull et al., "Introducing Sensory Studies," *Senses and Society* 1, no. 1 (March 1, 2006): 6, 7.

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48. Rhiannon Newton, "Embodying an Ecological Condition: Dance Practices and the Development of Embodied Ecological Awareness" (master's thesis, University of New South Wales, 2022); Tema Milstein and José Castro-Sotomayor, "Surviving and Thriving: The Ecocultural Identity Invitation," in *Routledge Handbook of Ecocultural Identity*, ed. Tema Milstein and José Castro-Sotomayor (London: Routledge, 2020), 475–477.

49. Schneemann, *Uncollected Texts*, 116.

50. The places and actions that connect sensoriums across species offer opportunities for sensing metabolisms. This process has been aligned with, for scholar Vinciane Despret, "attunement," and moves beyond scholar Martin Heidegger's anxious moody "attunement" to include mutually evolved behaviors. Despret finds "attunement" in human-animal domestication practices where animals "allow themselves to be pervaded by humans." This mutual permeability could be thought of as sensoriums touching or commingling. Vinciane Despret, "The Body We Care For: Figures of Anthropo-Zoo-Genesis," *Body and Society* 10, no. 2–3 (2004): 125.

51. Mol details how "eating (pertaining to bodily substances, a metabolic activity, and involving untrustworthy senses) has been persistently downgraded." She complicates this valuing of the senses by observing how vision can (and does) occur "in" the body, while taste "does not necessarily fold the body in on itself," given how knowledge about taste can be "perceptive." Mol, *Eating in Theory*, 3, 54.

52. Bruno Latour, "How to Talk about the Body? The Normative Dimension of Science Studies," *Body and Society* 10, no. 2–3 (2004): 205–229.

53. Bull et al., "Introducing Sensory Studies," 6.

54. Donna Haraway, *When Species Meet* (Minneapolis: University of Minnesota Press, 2008), 4.

55. Desiree Förster, *Aesthetic Experience of Metabolic Processes* (Lüneburg, Germany: Meson, 2021). Mammalian metabolisms rely on oxygen just as much as they do on nutrition. On oxygen, air, and their biocultural significance, see Samantha Frost, *Biocultural Creatures: Toward a New Theory of the Human* (Durham, NC: Duke University Press, 2016); Emily Parsons-Lord, "AIR WORKS: Air as Material in Contemporary Installation and Performance Art in a Time of Climate Emergency" (PhD diss., University of New South Wales, 2021), http://unsworks.unsw.edu.au/fapi/datastream/unsworks:76641/SOURCE02?view=true; Anicka Yi et al., *Anicka Yi: In Love with the World* (London: Tate Publishing, 2021).

56. Mol, *Eating in Theory*, 3.

57. Mol, *Eating in Theory*, 49. Beginning with philosopher Maurice Merleau-Ponty's work on embodied thinking, Mol considers his example of walking around his home. Merleau-Ponty successfully navigates his apartment because his body knows what to do. He understands the difference between furniture legs and limbs.

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Anthropologist Tim Ingold takes this integrated body outdoors, leaving furniture behind to find relations with weather and topography. But neither of these bodies are eating bodies; inside and outside remain distinct. Merleau-Ponty does not gnaw at his furniture, and Ingold does not swallow the rain or nibble at the landscape. Eating changes body and world.

58. Astrida Neimanis, *Bodies of Water: Posthuman Feminist Phenomenology* (London: Bloomsbury, 2016).

59. A rich literature tracks the spaces and questions shared by the arts and science and technology studies. See Chris Salter, Regula Valérie Burri, and Joseph Dumit, "Art, Design, and Performance," in *The Handbook of Science and Technology Studies*, ed. Ulrike Felt et al. (Cambridge, MA: MIT Press, 2016), 139–167; Henk Borgdorff, Peter Peters, and Trevor Pinch, eds., *Dialogues between Artistic Research and Science and Technology Studies* (New York: Routledge, 2019); Philippe Sormani, Guelfo Carbone, and Priska Gisler, eds., *Practicing Art/Science: Experiments in an Emerging Field* (New York: Routledge, 2019).

60. Scholar Joseph Dumit observes that "artists, sociologists, scientists, activists, science fiction writers, historians, all find that their worlds have thoroughly infected each other." Joseph Dumit, "Foreword: Biological Feedback," in *Tactical Biopolitics: Art, Activism and Technoscience*, ed. Beatriz da Costa and Kavita Philip (Cambridge, MA: MIT Press, 2008), xi–xiv. Scholars Lizzie Muller, Lynn Froggett, and Jill Bennett describe this infectious state as "the 'third culture' of art-science, a heterogeneous field of collaborative scientific and aesthetic investigations . . . distinguished by . . . its capacity to connect audiences and stakeholders to researchers in ways that are mutually enhancing." Lizzie Muller, Lynn Froggett, and Jill Bennett, "Emergent Knowledge in the Third Space of Art-Science," *Leonardo* 53, no. 3 (2020): 321. Scholars Caroline Jones and Peter Galison focus on the "boundary conditions" of science and art, asking, "What are the conditions under which objects become visible in culture, and in what manner are such visibilities characterized as 'science' or 'art?'" Caroline Jones and Peter Galison, introduction to *Picturing Science, Producing Art*, ed. Caroline Jones and Peter Galison (New York: Routledge, 1998), 1.

## PART I

1. Sara Ahmed, *Living a Feminist Life* (Durham, NC: Duke University Press, 2017), 247.

2. Kjerstin Gruys, "Can a Feminist Diet?," *Society Pages* (blog), July 14, 2011, https://thesocietypages.org/socimages/2011/07/14/can-a-feminist-diet/; Susie Orbach, *Fat Is a Feminist Issue* (New York: Random House, 2016).

3. Natalie Jovanovski, *Digesting Femininities: The Feminist Politics of Contemporary Food Culture* (London: Palgrave Macmillan, 2017), 154.

4. Silvia Federici, *Beyond the Periphery of the Skin: Rethinking, Remaking, and Reclaiming the Body in Contemporary Capitalism* (Oakland, CA: PM Press, 2020), 35.

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5. Nicole Woods, "Taste Economies: Alison Knowles, Gordon Matta-Clark and the Intersection of Food, Time and Performance," *Performance Research* 19, no. 3 (2014): 157.

6. Linda Montano, *Performance Artists Talking in the Eighties* (Berkeley: University of California Press, 2000), 173.

7. Tate, "Alison Knowles—'I'm Making a Giant Salad' | TateShots," YouTube, September 4, 2008, https://www.youtube.com/watch?v=lmqvnIXnmyM.

8. Montano, *Performance Artists Talking in the Eighties*, 173.

9. Hannah Higgins, *Fluxus Experience* (Berkeley: University of California Press, 2002), 47–48.

10. Lauren Fulton, "Sonic Possibilities, Meditations on Being, and the Mysterious Wisdom of Alison Knowles," in *by Alison Knowles: A Retrospective (1960–2022)*, ed. Karen Moss (Berkeley: University of California, Berkeley Art Museum and Pacific Film Archive, 2022), 69; Lucia Fabio, "Touch, Listen, Smell, Eat, Look: Intersensory Perception in the Work of Alison Knowles," in *by Alison Knowles*, 57.

11. "Candy Works," Felix Gonzalez-Torres Foundation, accessed January 20, 2022, https://www.felixgonzalez-torresfoundation.org/works/c/candy-works. I am following the Felix Gonzalez-Torres Foundation in omitting the accents from "Félix" and "González."

12. Hans Ulrich Obrist, "González-Torres, Félix," in *Hans Ulrich Obrist: Interviews*, ed. Thomas Boutoux (Florence: Fondazione Pitti Immagine Discovery, 2003), 315.

13. Montano, *Performance Artists Talking in the Eighties*, 174.

14. Amelie Hastie documents her life as something akin to an antisynesthete. When her olfactory nerves were severed during a brain surgery, she became an "anosmiac," a variation on "anosmic" Hastie invented to "offer a maniacal quality to my new identity." She "can still taste the basic four: sweet, sour, salty and bitter," but "nothing herbal, nothing floral—nothing that we actually experience through olfaction rather than taste—gets through to me." Hastie's senses have been separated surgically, and in the absence of smell, she reveals how ordinary acts of eating a rosemary-infused tomato sauce or drinking lavender tea have always been crossmodal experiences. Amelie Hastie, "Senseless Eating," *Parallax* 19, no. 1 (2013): 64, 65.

## CHAPTER 1

1. Lucy Aphramor and Jacqui Gingras, "That Remains to Be Said: Disappeared Feminist Discourses on Fat in Dietetic Theory and Practice," in *The Fat Studies Reader*, ed. Esther Rosenblum and Sondra Solovay (New York: NYU Press, 2009), 97–105.

2. Emily Newman reinforces how dieting "would eventually become a topic for artists to address . . . because artists, like the general population, would inevitably

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diet themselves," although "it became increasingly hard to distinguish whether the weight loss is for health, appearance, or the artwork itself." Emily Newman, *Female Body Image in Contemporary Art: Dieting, Eating Disorders, Self-Harm, and Fatness* (New York: Routledge, 2018), 25.

3. Jill Bennett, Lynn Froggett, and Lizzie Muller, "Psychosocial Aesthetics and the Art of Lived Experience," *Journal of Psychosocial Studies* 12, no. 1–2 (2019): 186.

4. Hannele Harjunen, "Fatness and Consequences of Neoliberalism," in *The Routledge International Handbook of Fat Studies*, ed. Cat Pausé and Sonya Renee Taylor (New York: Routledge, 2021), 68–77.

5. Alice Butler, "Eleanor Antin on Art, Ageing and Grief," Frieze, May 29, 2019, https://www.frieze.com/article/eleanor-antin-art-ageing-and-grief.

6. Patrick Geddes and Arthur Thomson, *The Evolution of Sex* (London: W. Scott, 1889).

7. Antin details her restrictive regimen for both performances: "I just cut things out: cake, ice cream, bread. I love bread; that was hard. I didn't do anything special, but for the second CARVING I asked my doctor, and he said: 'Just cut out carbs.' Then, I cut out lunch. It felt fine." Quoted in Butler, "Eleanor Antin on Art, Ageing and Grief."

8. A study designed to ascertain the effectiveness of insulin-like growth factor I in treating catabolic states found that a catabolic state can be induced in as little as two weeks. Ringgold and Antin dieted for longer than two weeks. D. R. Clemmons, A. Smith-Banks, and L. E. Underwood, "Reversal of Diet-Induced Catabolism by Infusion of Recombinant Insulin-like Growth Factor-I in Humans," *Journal of Clinical Endocrinology and Metabolism* 75, no. 1 (1992): 234–238.

9. Natalie Jovanovski, *Digesting Femininities: The Feminist Politics of Contemporary Food Culture* (London: Palgrave Macmillan, 2017), 201.

10. Ashley Marcin, "Catabolism vs. Anabolism: What's the Difference?," Healthline, August 6, 2019, https://www.healthline.com/health/catabolism-vs-anabolism.

11. Physiologist Walter Gaskell was one of the first to name the two main types of metabolic reactions: catabolism (katabolism) and anabolism. Gaskell describes "the condition of equilibrium which we denote by the term rest being brought about by the counterbalancing of the two opposite processes of destructive and constructive metabolism, or as Hering has called them of assimilation and dissimilation. In other words metabolism includes the two opposite processes of destruction and construction, or as they may be called of katabolism and anabolism." Walter Gaskell, "The Structure, Distribution and Function of the Nerves Which Innervate the Visceral and Vascular Systems," *Journal of Physiology* 7, no. 1 (1886): 46.

12. Herman Pontzer et al., "Daily Energy Expenditure through the Human Life Course," *Science* 373, no. 6556 (August 13, 2021): 808–812, https://doi.org/10.1126/science.abe5017.

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13. Herman Pontzer, *Burn: The Misunderstood Science of Metabolism* (New York: Penguin, 2021), 103.

14. Anson Rabinbach, *The Human Motor: Energy, Fatigue, and the Origins of Modernity* (Berkeley: University of California Press, 1992); Silvia Federici, *Beyond the Periphery of the Skin: Rethinking, Remaking, and Reclaiming the Body in Contemporary Capitalism* (Oakland, CA: PM Press, 2020), 14.

15. Pontzer, *Burn*, 183.

16. Radical dietician and poet Lucy Aphramor and sociologist Jacqui Gingras argue that "the true danger of the energy balance metaphor lies not in its failure to precisely explain metabolism but in the constricting hold that it has over the collective dietetic imagination." Aphramor and Gingras, "That Remains to Be Said," 99.

17. "About Faith," Faith Ringgold, n.d., https://www.faithringgold.com/about-faith/.

18. Sidonie Smith, "Bodies of Evidence: Jenny Saville, Faith Ringgold, and Janine Antoni Weigh In," in *Interfaces: Women, Autobiography, Image, Performance*, ed. Sidonie Smith and Julia Watson (Ann Arbor: University of Michigan Press, 2002), 147.

19. Dale Harding and Kate Harding's *Through a Lens of Visitation* (2022) explicitly invokes the connections between body, quilt, and country. In the installation, "the plinths signalled 'hierarchies of care.' They adopted this gallery convention to present Indigenous culture with the same care reserved for classical treasures." Scott East, "D Harding and Kate Harding: Two Artists Exploring Connections between Mother and Child, and the Culture That Forged Them," The Conversation, August 2, 2022, https://theconversation.com/d-harding-and-kate-harding-two-artists-exploring-connections-between-mother-and-child-and-the-culture-that-forged-them-186825.

20. Some prefer the more formal "change of matter" when translating *Stoffwechsel*. It has been translated into French as "le renouvellement du matériel," suggesting renewal and revitalization more than movement and change. Sillman titled her 2016 exhibition at Sikkema Jenkins and Co. *Stuff Change*, inquiring after the work of making and viewing paintings. Sillman's articulation of her process as a painter as metabolic transformations speaks to many of the works in this chapter. Franklin Bing, "History of the Word 'Metabolism,'" *Journal of the History of Medicine and Allied Sciences* 26, no. 2 (1971): 167; "Amy Sillman, *Stuff Change*, February 4–March 12, 2016," Sikkema Jenkins and Co, 2016, https://www.sikkemajenkinsco.com/stuff-change.

21. Le'a Kent, "Fighting Abjection: Representing Fat Women," in *Bodies Out of Bounds: Fatness and Transgression*, ed. Jana Evans Braziel and Kathleen LeBesco (Berkeley: University of California Press, 2001), 134.

22. Scholar Joyce Millman traces Ringgold's quilting lineage: "Ringgold's mother taught her quilting in the tradition of African American quilt making, which was passed down from Faith's great-grandmother, a former slave." Joyce Millman, "Faith

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Ringgold's Quilts and Picturebooks: Comparisons and Contributions," *Children's Literature in Education* 36, no. 4 (2005): 383.

23. Olga Idriss Davis, "The Rhetoric of Quilts: Creating Identity in African-American Children's Literature," *African American Review* 32, no. 1 (1998): 68.

24. Faith Ringgold, *We Flew over the Bridge: The Memoirs of Faith Ringgold* (Durham, NC: Duke University Press, 2005), 238.

25. Barbara Montero, "Proprioception as an Aesthetic Sense," *Journal of Aesthetics and Art Criticism* 64, no. 2 (2006): 240.

26. Macarena Gómez-Barris, *The Extractive Zone: Social Ecologies and Decolonial Perspective*s (Durham, NC: Duke University Press, 2017),107.

27. Linda Montano, *Performance Artists Talking in the Eighties* (Berkeley: University of California Press, 2000), 193, 195.

28. Ringgold explains, "I became a presence because there was so much of me. I adopted that style in the seventies. There was a certain power about it, but now I'm into strength, physical strength, that's why I lift weights. I want to develop muscles because I've feared that if I was thin, I might be attacked and hurt. I feel that a lot of overweight people are big so they can protect themselves. . . . 'You don't have to be fat to be strong.'" Quoted in Montano, *Performance Artists Talking in the Eighties*, 197.

29. Oprah Winfrey Network, "#3 Exclusive: Where Did Oprah Get 67 Pounds of Fat?," YouTube, September 2012, https://www.youtube.com/watch?v=xoVmIyzNn-8&feature=emb_imp_woyt.

30. Kristina Rodulfo, "Oprah Regrets That 'Wagon of Fat' Episode," *Elle*, November 28, 2016, https://www.elle.com/culture/movies-tv/news/a41002/oprah-show-facts/.

31. Art historian Emily Newman describes Ringgold's interactions onstage with her lost weight: "Throughout the performances, she brought out twenty two-liter soda bottles filled with water and placed in two large, black garbage bags, which she attempted to pull around the space. Collectively symbolizing the weight that she had lost, the bottles did not budge easily, a blatant metaphor for the burden of the extra pounds she carried." Newman, *Female Body Image in Contemporary Art*, 38.

32. Joanna Frueh, "The Body through Women's Eyes," in *The Power of Feminist Art: The American Movement of the 1970s, History and Impact*, ed. Norma Broude and Mary Garrard (New York: Harry N. Abrams, 1996), 195.

33. Eleanor Antin and Dhyandra Lawson, "Eleanor Antin: Time's Arrow // Museum Exhibition," Vimeo, 2019, https://vimeo.com/341487327.

34. Eleanor Antin, *Carving: A Traditional Sculpture*, 1972; quotation from the wall text accompanying the installation.

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35. Clare Johnson, *Femininity, Time and Feminist Art* (New York: Palgrave, 2013), 42.

36. Kimberlé Crenshaw, *On Intersectionality: Essential Writings* (New York: New Press, 2017).

37. Amelia Jones, *Body Art / Performing the Subject* (Minneapolis: University of Minnesota Press, 1998), 31, 26, 27, 29, 33.

38. Lynn Turner, "Introduction: The Animal Question in Deconstruction," in *The Animal Question in Deconstruction*, ed. Lynn Turner (Edinburgh: Edinburgh University Press, 2013), 1–8.

39. Bennett, Froggett, and Muller, "Psychosocial Aesthetics and the Art of Lived Experience." The Whitney rejected Antin's response to its sculpture biennial invitation, finding *Carving* too conceptual and not sufficiently sculptural. Remembering the work in 2019, Antin explains that she "was laughing at the boys. I call them the boys—the conceptualists." Butler, "Eleanor Antin on Art, Ageing and Grief."

40. Quoted in Butler, "Eleanor Antin on Art, Ageing and Grief."

41. Quoted in Butler, "Eleanor Antin on Art, Ageing and Grief."

42. Eleanor Antin, *Eleanor Antin: Time's Arrow* (Los Angeles: Los Angeles County Museum of Art, 2019).

43. Antin, *Carving*.

44. For this "obese, metabolically normal subgroup, . . . attempts at weight loss may be counterproductive." Ethan Sims, "Are There Persons Who Are Obese, but Metabolically Healthy?," *Metabolism* 50, no. 12 (2001): 1499. Regarding the words "obese," "obesity," and "overweight," I follow the editors of *The Fat Studies Reader* in "choosing to surround the O-words with scare quotes to indicate their compromised status" and "reclaiming the word fat, both as the preferred neutral adjective . . . and also as a preferred term of political identity." Esther Rothblum and Sandra Solovay, eds., *The Fat Studies Reader* (New York: NYU Press, 2009), xii; Samuel Klein, Elisa Fabbrini, and Johannes Romijn, "Obesity," in *Williams Textbook of Endocrinology*, ed. Shlomo Melmed et al. (Amsterdam: Elsevier, 2011), 1613–1614.

45. *Cuts: A Traditional Sculpture* was presented by Los Angeles Contemporary Exhibitions as part of "Los Angeles Goes Live: Performance Art in Southern California 1970–1983." Cassils has a long history of engaging with archives, from their first internship digitizing video at Franklin Furnace to creating *Becoming an Image* (2012–) for the ONE Archives in Los Angeles, the largest LGBTQI archive in the United States. Giovanni Aloi and Susan McHugh, "Interview with Cassils: Becoming an Image," in *Posthumanism in Art and Science: A Reader*, ed. Giovanni Aloi and Susan McHugh (New York: Columbia University Press, 2021), 30–31.

46. Cassils, "Cuts: A Traditional Sculpture," Cassils, 2013, https://www.cassils.net/cassils-artwork-cuts.

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47. Cassils, "A Continual Becoming," AGOinsider, July 6, 2022, https://ago.ca/agoinsider/continual-becoming.

48. Cassils, "A Continual Becoming."

49. Aloi and McHugh, "Interview with Cassils," 28; Heather Cassils, "A Traditional Sculpture (VIDEO)," *HuffPost*, October 4, 2011, https://www.huffpost.com/entry/a-traditional-sculpture_b_983384.

50. Antin, *Carving*.

51. Cassils, "About," Cassils, 2020, http://new.cassils.net/about/.

52. Bryan Chung, "Muscle Dysmorphia: A Critical Review of the Proposed Criteria," *Perspectives in Biology and Medicine* 44, no. 4 (2001): 565–574.

53. Francesca Steele, "Breaking the Mirror," *Performance Research: A Journal of the Performing Arts* (2018): 54.

54. Cassils, "A Traditional Sculpture (VIDEO)."

55. Steele, "Breaking the Mirror," 54.

56. E. Hella Tsaconas, "Bad Math: Calculating Bodily Capacity in Cassils's Cuts: A Traditional Sculpture," *Women and Performance: A Journal of Feminist Theory* 26, no. 2–3 (2016): 204, 198.

57. Kathy Acker, "Against Ordinary Language: The Language of the Body," in *The Last Sex: Feminism and Outlaw Bodies*, ed. Arthur Kroker and Marilouise Kroker (New York: St. Martin's Press, 1993), 26, 20, 22.

58. Carl Dyke derives "Big Bothering" from "the Lacanian Big Other and Zizek's gesture at revolutionary maximalism." Carl Dyke, "Obeasts, Meta-Activism and Big Bothering," in *Obeast: A Broader View*, ed. Rachel Herrick (Portland, OR: Publication Studio, 2013), 59.

59. Deborah Bright, "Portfolio Introduction," in *The Passionate Camera: Photography and Bodies of Desire*, ed. Deborah Bright (New York: Routledge, 1998), 298.

60. Rachel Herrick, "About the Museum for Obeast Conservation Studies (MOCS)," Rachel Herrick, 2014, https://www.rachelherrick.com/about-the-museum-for-obeast-conservation-studies-mocs-/1.

61. Donna Haraway suggests that "there can be an elsewhere, not as a utopian fantasy or relativist escape, but an elsewhere born out of the hard (and sometimes joyful) work of getting on together in a kin group that includes cyborgs and goddesses working for earthly survival." Donna Haraway, "A Kinship of Feminist Figurations," in *The Haraway Reader* (New York: Routledge, 2004), 3.

62. Rachel Herrick, "Hello Alberta!," Rachel Herrick, October 11, 2013, https://rachelherrick.wordpress.com/2013/10/11/hello-alberta/.

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63. Stefanie Snider, "Fatness and Visual Culture: A Brief Look at Some Contemporary Projects," *Fat Studies* (2012): 28.

64. Dyke, "Obeasts, Meta-Activism and Big Bothering," 60.

65. Rachel Herrick, "MOCSvideos," YouTube, 2011, https://www.youtube.com/channel/UCKUM-qwvYrleOoheoThlJ3w/videos.

66. An expansive field of social metabolism (Manuel González de Molina and Victor Toledo) includes industrial metabolism (Marina Fischer-Kowalksi) and anthropogenic metabolism (Paul Brunner and Helmut Rechberger). Manuel González de Molina and Victor Toledo, *The Social Metabolism: A Socio-Ecological Theory of Historical Change* (Berlin: Springer, 2014); Paul Brunner and Helmut Rechberger, "Anthropogenic Metabolism and Environmental Legacies," in *Encyclopedia of Global Environmental Change*, ed. Ian Douglas and Ted Munn (Hoboken, NJ: Wiley, 2002), 54–72. Sociologist Marina Fischer-Kowalksi notes that since its first usage in the mid-1800s, "'metabolism,' both as applied to organisms and to human social systems, was born pretty much at the same time in biology and in social theory." Marina Fischer-Kowalski, "On the History of Industrial Metabolism," in *Perspectives on Industrial Ecology*, ed. Dominique Bourg and Suren Erkman (London: Taylor and Francis, 2003), 37. Metabolism architecture in postwar Japan (from 新陳代謝, *shinchintaisha*, "replacing the old with the new") conveys the organic life of urban environments. Kisho Kurokawa, *Metabolism in Architecture* (London: Studio Vista, 1977). Sanitation engineer Abel Wolman's "Metabolism of Cities" prefigured "urban metabolism," a complex multidisciplinary framework accommodating scholarship on sustainability, material flows, social change, and ecological processes. Vanesa Castán Broto, Adriana Allen, and Elizabeth Rapoport, "Interdisciplinary Perspectives on Urban Metabolism," *Journal of Industrial Ecology* (2012): 851–861. Environmental sociologist John Bellamy Foster elaborates on Marx to develop the concept of "metabolic rift," which describes a growing imbalance between rural and urban environments under capitalism. John Bellamy Foster, "Marx's Theory of Metabolic Rift: Classical Foundations for Environmental Sociology," *American Journal of Sociology* 105, no. 2 (1999): 366–405.

67. Starting with the origin story of Teddy Roosevelt's stuffed bear, the teddy bear, Haraway's "Teddy Bear Patriarchy" interrogates how taxidermy diorama displays act as "a medical technology, a hygienic intervention, and the pathology was a potentially fatal organic sickness of the individual and collective body." The stuffed animal, an outcome of extractionist colonial specimen collection (hunting), becomes heir to and offspring of conquering explorers such as Roosevelt and Carl Akeley. Museum displays promote what Haraway refers to as "genetic hygiene" undertaken in the face of "a miscellaneous and incoherent public threatened with genetic and social decadence." In the turn of the century United States, these included "the prolific bodies of the new immigrants" and "failure of manhood," but today, "obesity" and metabolic disorders could arguably be included among Haraway's "potentially fatal

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organic sickness[es] of the individual and collective body." Donna Haraway, "Teddy Bear Patriarchy: Taxidermy in the Garden of Eden, New York City, 1908–1936," in *The Haraway Reader* (New York: Routledge, 2004), 187, 154, 187.

68. Herrick, "About the Museum for Obeast Conservation Studies (MOCS)." Paul Campos and coauthors prefer "obesity panic" to the commonly used phrase "obesity epidemic," given "the moral connotations ascribed to weight gain." Paul Campos et al., "The Epidemiology of Overweight and Obesity: Public Health Crisis or Moral Panic?," *International Journal of Epidemiology* 35, no. 1 (2006): 59.

69. Katmai National Park, "Fat Bear Week 2020," Explore, 2020, https://explore.org/fat-bear-week.

70. Peter Stenvinkel, Alkesh H. Jani, and Richard J. Johnson, "Hibernating Bears (Ursidae): Metabolic Magicians of Definite Interest for the Nephrologist," *Kidney International* 83, no. 2 (February 1, 2013): 207–212.

71. Donna Haraway, *When Species Meet*.

72. Tsaconas, "Bad Math."

73. Biomedical physiologist Dale Schoeller argues that "many of the prospective applications of the energy balance equation are over-simplified and often the wrong way to think about obesity prevention or reversal," primarily due to confusion about how to calculate the equation: "one should not consider energy intake or energy expenditure as the independent variable, but instead consider interventions that influence fat balance and energy balance." Dale Schoeller, "The Energy Balance Equation: Looking Back and Looking Forward Are Two Very Different Views," *Nutrition Reviews* 67, no. 5 (2009): 253. Even though small changes can make a big difference to body composition, Kevin Hall and coauthors note that "our ability to measure precisely individual components of energy expenditure or energy intake is relatively poor." Kevin Hall et al., "Energy Balance and Its Components: Implications for Body Weight Regulation," *American Journal of Clinical Nutrition* 95 (2012): 993. For more on "self-tracking cultures," see Deborah Lupton, *The Quantified Self: A Sociology of Self-Tracking* (Cambridge, UK: Polity Press, 2016).

74. Landecker marks the transition from industrial to postindustrial metabolism: "knowledge of metabolism in the postindustrial period is suffused with environmental risk, regulation, and information"; instead of a factory, metabolism becomes an interface. Hannah Landecker, "Postindustrial Metabolism: Fat Knowledge," *Public Culture* 25, no. 3 (2013): 497.

75. Landecker explains that "postindustrial metabolism . . . both comes after and is very materially and literally produced by industrial metabolism." Landecker, "Postindustrial Metabolism," 516.

76. Landecker, "Postindustrial Metabolism."

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77. Pontzer, *Burn*, 230, 183.

78. Lynn Margulis, "Symbiogenesis and Symbionticism," in *Symbiosis as a Source of Evolutionary Innovation: Speciation and Morphogenesis*, ed. Lynn Margulis and René Fester (Cambridge, MA: MIT Press, 1991), 1–14.

79. Jones, *Body Art / Performing the Subject*, 187.

80. Nina Sellars, "Fat Matters: Fluid Interventions in Anatomy," in *Fluid Matter(s): Flow and Transformation in the History of the Body*, ed. Natalie Köhle and Shigehisa Kuriyama (Canberra: ANU Press, 2020), https://press-files.anu.edu.au/downloads/press/n7034/html/13-fat-matters/index.html.

81. Landecker, "Postindustrial Metabolism."

82. In the key feminist texts Elizabeth Wilson analyzes (notably Gayle Rubin's "The Traffic in Women" and "Thinking Sex"), biology and culture operate independently, and "eating and hunger often figure in feminist work as the mark against which more cultivated critical and political stances could be built." Elizabeth Wilson, *Gut Feminism* (Durham, NC: Duke University Press, 2015), 22.

83. Wilson, *Gut Feminism*, 35.

84. John Germov and Lauren Williams, "The Epidemic of Dieting Women: The Need for a Sociological Approach to Food and Nutrition," *Appetite* 27 (1996): 97–108.

85. To overthrow the Teddy Bear Patriarchy, obeasts must maintain a threatening aura. Food studies scholar Kathleen LeBesco's analysis of the word "revolting" counters how "fat people are widely represented in popular culture and in interpersonal interactions as revolting—they are agents of abhorrence and disgust. But if we think of revolting in terms of overthrowing authority, rebelling, protesting, and rejecting, then corpulence carries a whole new weight as a subversive cultural practice that calls into question received notions about health, beauty, and nature. We can recognize fat as a condition not simply aesthetic or medical, but political." Kathleen LeBesco, "Queering Fat Bodies/Politics," in *Bodies Out of Bounds: Fatness and Transgression*, ed. Jana Evans Braziel and Kathleen LeBesco (Berkeley: University of California Press, 2001), 75.

## CHAPTER 2

1. Douwe Verkuyl, "Oral Conception: Impregnation via the Proximal Gastrointestinal Tract in a Patient with an Aplastic Distal Vagina. Case Report," *British Journal of Obstetrics and Gynaecology* (1988): 933.

2. Lauren Cox, "Oral Sex, a Knife Fight and Then Sperm Still Impregnated Girl," ABC News, February 3, 2010, https://abcnews.go.com/Health/Wellness/teen-girl-vagina-pregnant-sperm-survival-oral-sex/story?id=9732562.

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3. Claudia Castañeda, *Figurations: Child, Bodies, Worlds* (Durham, NC: Duke University Press, 2002), 46–82, 3.

4. I place "beside" in all the rich spatial fullness Eve Kosofsky Sedgwick brings to this "spacious agnosticism about several of the linear logics that enforce dualistic thinking." Eve Kosofsky Sedgwick, *Touching Feeling: Affect, Pedagogy, Performativity* (Durham, NC: Duke University Press, 2003), 8.

5. *Durian Wombs* was an edible tissue phantom performance undertaken as part of the exhibition *Human Non Human* at the Powerhouse Museum of Applied Arts and Sciences in Sydney, Australia. *Human Non Human* was curated by Lizzie Muller and Katie Dyer with funding from an Australian Research Council Linkage grant.

6. Lily Anne Harrison, "Lily Anne Harrison on Instagram," Instagram, June 27, 2022, https://www.instagram.com/p/CfPmCvEpWT9/.

7. Lisa Heldke, "An Alternative Ontology of Food: Beyond Metaphysics," *Radical Philosophy Review* 15, no. 1 (2012): 83; Annemarie Mol, *Eating in Theory* (Durham, NC: Duke University Press, 2021), 110; Anthony Winson, *The Industrial Diet: The Degradation of Food and the Struggle for Healthy Eating* (New York: NYU Press, 2013), 18.

8. Hannah Landecker, "Metabolism, Reproduction, and the Aftermath of Categories," *S&F Online* 11, no. 3 (2013), https://sfonline.barnard.edu/metabolism-reproduction-and-the-aftermath-of-categories/; Lin Zhang et al., "Exogenous Plant MIR168a Specifically Targets Mammalian LDLRAP1: Evidence of Cross-Kingdom Regulation by MicroRNA," *Cell Research* 22, no. 1 (January 1, 2012): 107–126, https://doi.org/10.1038/cr.2011.158.

9. Landecker, "Metabolism, Reproduction, and the Aftermath of Categories"; Vanessa Ezenwa et al., "Animal Behavior and the Microbiome," *Science* 338 (2012): 198–199.

10. Landecker, "Metabolism, Reproduction, and the Aftermath of Categories"; Kai Wang et al., "The Complex RNA Spectra in Human Plasma: An Interface with Human Gut Biota?," *PLoS ONE* 7, no. 12 (2012): e51009.

11. Landecker, "Metabolism, Reproduction, and the Aftermath of Categories."

12. Donna Haraway, *Staying with the Trouble: Making Kin in the Chthulucene* (Durham, NC: Duke University Press, 2016), 102.

13. Adele Clarke, "Introducing Making Kin Not Population," in *Making Kin Not Population*, ed. Adele Clarke and Donna Haraway (Chicago: Prickly Paradigm, 2018), 9.

14. Quoted in Clarke, "Introducing Making Kin Not Population," 4.

15. Landecker, "Metabolism, Reproduction, and the Aftermath of Categories."

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16. Astrida Neimanis, *Bodies of Water: Posthuman Feminist Phenomenology* (London: Bloomsbury, 2016), 92.

17. Myra Hird, "Digesting Difference: Metabolism and the Question of Sexual Difference," *Configurations* 20, no. 3 (2012): 231, 236.

18. Hannah Landecker, "Food as Exposure: Nutritional Epigenetics and the New Metabolism," *BioSocieties* (2011): 169.

19. I borrow "nonnatalist," more accommodating than "antinatalist," from Adele Clarke and Donna Haraway, eds., *Making Kin Not Population* (Chicago: Prickly Paradigm, 2018).

20. Donna Haraway, "Making Kin in the Chthulucene: Reproducing Multispecies Justice," in *Making Kin Not Population*, ed. Adele Clarke and Donna Haraway (Chicago: Prickly Paradigm, 2018), 69.

21. Deborah Bird Rose, "What If the Angel of History Were a Dog?," *Cultural Studies Review* 12, no. 1 (2006): 75.

22. Haraway, "Making Kin in the Chthulucene," 69.

23. Natalie Loveless, "Afterwords: Research-Creation and the University in Knots," in *Knowings and Knots: Methodologies and Ecologies in Research-Creation* (Edmonton: University of Alberta Press, 2019), 303.

24. Johan Lundström et al., "Maternal Status Regulates Cortical Responses to the Body Odor of Newborns," *Frontiers in Psychology* 4, no. 597 (2013): 4.

25. Zhu Yu's *Eating People* (2000) offers perhaps the most graphic approach to eating babies, or in this case, fetuses, in contemporary art. A series of photographs that were pulled from the exhibition *Fuck You / The Uncooperative Approach*, a salon des refusés coinciding with the state-sponsored Shanghai Biennial, Zhu can be seen washing, preparing, and taking enthusiastic bites out of a human fetus. (The color and texture of the fetus suggest a preserved specimen, but eating or even pretending to eat any kind of fetus leaves a "violent and haunting legacy.") Wenny Teo, "Cannibalism, Capitalism and the Cross-Cultural Politics of Eating People," *Journal of Visual Art Practice* 11, no. 2–3 (2012): 189. I am grateful to Megan Fizell for suggesting the relevance of this work.

26. Women and men experience food babies differently. Even though men bloat too, a collage of men carrying food babies, the only such image I have found, appears to celebrate visceral abdominal fat as an ongoing static, even earned condition. Because visceral fat does not change in appearance after eating, there are no before and after shots here.

27. Merrell Twins, "If Food Babies Were Real—Merrell Twins (FOOD BABY)," YouTube, November 18, 2018, https://www.youtube.com/watch?v=joMRNv0SlYE.

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28. Lundström et al., "Maternal Status Regulates Cortical Responses to the Body Odor of Newborns."

29. Elizabeth Wilson, *Gut Feminism* (Durham, NC: Duke University Press, 2015), 5.

30. Larissa Lai, *Salt Fish Girl* (Markham, ON: Thomas Allen, 2002), 48.

31. Lai, *Salt Fish Girl*, 15.

32. Paul Lai, "Stinky Bodies: Mythological Futures and the Olfactory Sense in Larissa Lai's *Salt Fish Girl*," *MELUS* 33, no. 4 (2008): 171.

33. Aimee Bahng, "Specters of the Pacific: Salt Fish Drag and Atomic Hauntologies in the Era of Genetic Modification," *Journal of American Studies* (2015): 680, 668.

34. Katie Dyer and Lizzie Muller, "Objects, Energies and Curating Resonance across Disciplines," in *Curating Lively Objects: Exhibitions beyond Disciplines*, ed. Lizzie Muller and Caroline Seck Langill (New York: Routledge, 2022), 192.

35. Nicole Shukin, *Animal Capital: Rendering Life in Biopolitical Times* (Minneapolis: University of Minnesota Press, 2009), 75.

36. Dyer and Muller, "Objects, Energies and Curating Resonance across Disciplines," 189.

37. I modeled *Durian Wombs* on one such phantom recipe. See Impress Women's Health, "Early Pregnancy Ultrasound Training Using Gelatin Models," YouTube, 2017, https://www.youtube.com/watch?v=KzbtxpUASHU.

38. For more about conceptual cannibalism, see Christine Chin's work, discussed in Lindsay Kelley, *Bioart Kitchen: Art, Feminism and Technoscience* (London: I. B. Tauris, 2016), 117–128.

39. Landecker, "Metabolism, Reproduction, and the Aftermath of Categories."

40. Hird, "Digesting Difference," 233.

41. Yu-Ling Huang and Chia-Ling Wu, "New Feminist Biopolitics in Ultra-Low-Fertility Asia," in *Making Kin Not Population*, ed. Adele Clarke and Donna Haraway (Chicago: Prickly Paradigm, 2018), 129, 144.

42. Ai Hasegawa, "I Wanna Deliver a Shark . . . ," Ai Hasegawa, 2012, https://aihasegawa.info/i-wanna-deliver-a-shark.

43. Ai Hasegawa, "I Wanna Deliver a Dolphin . . . ," Ai Hasegawa, 2013, https://aihasegawa.info/i-wanna-deliver-a-dolphin.

44. Neimanis, *Bodies of Water*, 109.

45. Ai Hasegawa, "I Wanna Deliver a . . . ," Vimeo, October 24, 2013, https://vimeo.com/77692389.

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46. Hasegawa does not link this film to either of her interspecies gestation projects on her website; it stands alone in her online repository of video works. Ai Hasegawa, "Untitled," Vimeo, 2011, https://vimeo.com/23021923.

47. Elspeth Probyn, *Eating the Ocean* (Durham, NC: Duke University Press, 2016), 2.

48. Landecker, "Metabolism, Reproduction, and the Aftermath of Categories."

49. Simone de Beauvoir, *The Second Sex* (New York: Penguin, 1972); Judith Butler, *Gender Trouble: Feminism and the Subversion of Identity* (New York: Routledge, 1990); Sophie Lewis, *Full Surrogacy Now: Feminism against Family* (London: Verso, 2019).

50. Hird, "Digesting Difference," 231.

## CHAPTER 3

1. Lu Yang, "Cancer Baby by Lu Yang," Vimeo, 2014, https://vimeo.com/90603945; Mary Maggic, "Egstrogen Farms: A Transgenic Chicken Commercial for Women," Mary Maggic Official, December 16, 2015, https://maggic.ooo/Egstrogen-Farms.

2. Higgins's taut undoing of humanist conditions of production is informed by kinship networks that lend heightened resonance to her observations: "In the Fluxkit, actual stuff is present—'That is a pom-pom'; it is not *about* a pom-pom unless a particular user proceeds down that path of association. Removing *of* and *about* represents two challenges to entrenched patterns of thought: first, if a piece is not *about* things but actually *is* them, then the signifying chain often applied to visual art in semiotic analyses needs to be modified to make physical or actual experiences central to the process of signification; second, . . . these works problematize the Western metaphysics since Plato and Aristotle, which insists on dividing primary experience . . . from secondary experience." Hannah Higgins, *Fluxus Experience* (Berkeley: University of California Press, 2002), 36.

3. Alexis Shotwell, "Flourishing Is Mutual: Relational Ontologies, Mutual Aid, and Eating," *Feminist Philosophy Quarterly* 7, no. 3 (2021): 15.

4. Herman Pontzer, *Burn: The Misunderstood Science of Metabolism* (New York: Penguin, 2021), 274.

5. Rebecca Fett, *It Starts with the Egg: How the Science of Egg Quality Can Help You Get Pregnant Naturally, Prevent Miscarriage, and Improve Your Odds in IVF* (New York: Franklin Fox, 2019).

6. Jorge Chavarro, Walter Willet, and Patrick Skerrett, *The Fertility Diet: Groundbreaking Research Reveals Natural Ways to Boost Ovulation and Improve Your Chances of Getting Pregnant* (New York: McGraw Hill, 2009).

7. subRosa, "Cultures of Eugenics," *Refugia* (blog), 2008, 2–3, http://home.refugia.net/portfolio/cultures-of-eugenics/.

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8. Susan M. Squier, *Poultry Science, Chicken Culture: A Partial Alphabet* (Piscataway, NJ: Rutgers University Press, 2011), 155, 139.

9. Donna Haraway, *When Species Meet* (Minneapolis: University of Minnesota Press, 2008), 274.

10. Mary Maggic and Byron Rich collaborate on the *Open Source Estrogen* projects. These biohacking, performance, and bioart works are designed to "help people to better understand the influence of estrogen and endocrine disruptors on our bodies and our environment." Ewen Chardronnet, "The Egg, the Chicken and DIY Hormones," Makery: Media for Labs, May 18, 2016, https://www.makery.info/en/2016/05/18/loeuf-la-poule-et-les-hormones-diy/.

11. Mary Maggic, "Egstrogen Farms," Vimeo, December 16, 2015, https://vimeo.com/149112412.

12. Chavarro, Willet, and Skerrett, *The Fertility Diet*, 2; Squier, *Poultry Science, Chicken Culture*, 148.

13. Maggic, "Egstrogen Farms: A Transgenic Chicken Commercial for Women"; Sun Kwon et al., "Generation of Transgenic Chickens Expressing the Human Erythropoietin (HEPO) Gene in an Oviduct-Specific Manner: Production of Transgenic Chicken Eggs Containing Human Erythropoietin in Egg Whites," *PLoS ONE* 13, no. 5 (2018): e0194721.

14. Lissa Herron et al., "A Chicken Bioreactor for Efficient Production of Functional Cytokines," *BMC Biotechnology* 18 (2018): article 82.

15. subRosa, "Cultures of Eugenics," 17.

16. S. Lochlann Jain, *Malignant: How Cancer Becomes Us* (Berkeley: University of California Press, 2013), 129.

17. Robert Nideffer, "In Loving Memory of Shani (6/11/74–12/27/12)," *Beatriz Health and Life Update: Periodic Posts for Beatriz's Friends and Family* (blog), 2012, http://www.nideffer.net/beatriz_health_and_life_update/?p=398; Donna Haraway, "Remembering Beatriz da Costa," University of California at Santa Cruz, History of Consciousness, January 7, 2013, https://histcon.ucsc.edu/news-events/news/beatriz-da-costa.html.

18. Nideffer, "In Loving Memory of Shani."

19. Beatriz da Costa, "Dying for the Other," Vimeo, 2012, https://vimeo.com/241349987.

20. Claire Pentecost, "Claire Pentecost," accessed June 18, 2022, http://www.publicamateur.org/.

21. Jain asks, "What cost is worth what benefit, and to whom? When? Why?" Jain, *Malignant*, 175.

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22. Jain, *Malignant*, 223.

23. Amy Claire Mills, *Unsolicited Advice!*, textile installation, dimensions variable, 2021, https://www.amyclairemills.com/copy-of-death-quilts.

24. Jain, *Malignant*, 79.

25. Elizabeth Wilson insists on the "resolutely anticonsilient" politics of gut feminisms, for these frameworks "offer no plans for repair except through the interpretation of our ongoing, anxious implication in envies, hostilities, and harms." Elizabeth Wilson, *Gut Feminism* (Durham, NC: Duke University Press, 2015), 170, 179.

26. Sara Ahmed, *Living a Feminist Life* (Durham, NC: Duke University Press, 2017), 78.

27. Wilson, *Gut Feminism*, 170; Jain, *Malignant*, 223.

28. Beatriz da Costa, "Directly from Me," *Beatriz Health and Life Update: Periodic Posts for Beatriz's Friends and Family* (blog), 2012, www.nideffer.net/beatriz_health_and_life_update/?p=372.

29. *DeMonstrable*, Lawrence Wilson Art Gallery, accessed July 30, 2016, www.lwgallery.uwa.edu.au/exhibitions/past/2015/demonstrable.

30. Lu Yang, "Cancer Baby by Lu Yang."

31. Lu did not grant permission for the reproduction of a still from *Cancer Baby* in this book because of my use of the word "feminist." Short of installation on a large screen with a Dance Dance Revolution mat, the Vimeo link cited earlier in this chapter's notes would be the ideal way to experience the work, but stills are available elsewhere. Lee's essay contains images of the "game play" sections of the video, and an image of the song sequence with organs can be found in a previously published version of this chapter. Lindsay Kelley, "The Political Life of Cancer," *Environmental Humanities* 9, no. 2 (November 1, 2017): 230–254, https://doi.org/10.1215/22011919-4215220; Jennifer Dorothy Lee, "Lu Yang's Cancer Baby: Coercions of the Image," *Screen Bodies* 7, no. 1 (Spring 2022): 16.

32. Lee, "Lu Yang's Cancer Baby," 25.

33. Hannah Landecker, "Food as Exposure: Nutritional Epigenetics and the New Metabolism," *BioSocieties* (2011): 190.

34. Elizabeth Stephens, Oron Catts, and Jennifer Johung, "DeMonstrable: The Ear-Mouse, Twenty Years Later: A Critical Reappraisal" (panel discussion at the Society for Science, Literature, and Art Neolife conference, Perth, Australia, October 1–3, 2015).

35. FemTechNet, "Feminism, Technology, and Transformation," Vimeo, November 25, 2013, https://vimeo.com/80248724.

36. Quoted in FemTechNet, "Feminism, Technology, and Transformation."

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37. Da Costa, "Dying for the Other."

38. Haraway, *When Species Meet*, 285, 339n34.

39. Haraway, *When Species Meet*, 83.

40. Jessica Ullrich, "Interview with Kathy High: Something We Are Responsible To (2016)," in *Posthumanism in Art and Science: A Reader*, ed. Giovanni Aloi and Susan McHugh (New York: Columbia University Press, 2021), 176.

41. Donna Haraway, *Modest_Witness@Second_Millennium.FemaleMan_Meets_OncoMouse: Feminism and Technoscience* (New York: Routledge, 1997), 79.

42. Ullrich, "Interview with Kathy High," 178.

43. Haraway writes, "Taking animals seriously as workers without the comforts of humanist frameworks for people or animals is perhaps new and might help stem the killing machines." Haraway, *When Species Meet*, 72, 73.

44. Scholar Federica Timeto dwells in these uncertainties, evoking Landecker's "food as exposure" framework: "A disease and thus a cure are part of life, and, as . . . da Costa's works show, are always done in practice, exceeding the realms of the seeable and the sayable within which bodies have been confined by traditional medicine." Federica Timeto, *Diffractive Technospaces: A Feminist Approach to the Mediations of Space and Representation* (Farnham, UK: Ashgate, 2015), 147.

45. Servan-Schreiber uses "terrain" throughout the book, with its first use in the introduction to the 2007 edition reading "this type of medicine . . . works with the 'terrain' at the same time that it addresses the disease." Terrain is the context for disease and more than a body; terrain includes epigenetic factors, like Landecker's "food as exposure." David Servan-Schreiber, *Anticancer: A New Way of Life* (New York: Viking, 2008), 2.

46. See, for example, Elizabeth K. Costello et al., "The Application of Ecological Theory toward an Understanding of the Human Microbiome," *Science* 336, no. 6086 (2012): 1255–1262; Luke McNally and Sam Brown, "Microbiome: Ecology of Stable Gut Communities," *Nature Microbiology* 1, no. 15016 (2016), https://www.nature.com/articles/nmicrobiol201516; Jens Walter and Ruth Ley, "The Human Gut Microbiome: Ecology and Recent Evolutionary Changes," *Annual Review of Microbiology* 65 (2011): 411–429. Elsewhere I have attended to how the human microbiome has been figured ecologically. Lindsay Kelley, "Cooking and Eating across Species: Natalie Jeremijenko's Cross(x)Species Adventure Club," in *The Taste of Art: Cooking, Food, and Counterculture in Contemporary Practices*, ed. Sylvia Bottinelli and Margherita d'Ayala Valva (Fayetteville: University of Arkansas Press, 2017), 279–292.

47. Michael Pollan, *Food Rules: An Eater's Manual* (New York: Penguin, 2010); Karen Q. Hall, "Toward a Queer Crip Feminist Politics of Food," *philoSOPHIA* 4, no. 2 (2014): 177–196; Shotwell, "Flourishing Is Mutual," 8.

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48. Crys Moore, "Beatriz Da Costa Rocket Hub Video," Vimeo, accessed July 30, 2016, https://vimeo.com/55487001. I was one of the project's funders.

49. Shotwell, "Flourishing Is Mutual," 19.

50. Moore, "Beatriz Da Costa Rocket Hub Video."

51. Beatriz da Costa, "Reaching the Limit: When Art Becomes Science," in *Tactical Biopolitics: Art, Activism, and Technoscience*, ed. Beatriz da Costa and Kavita Philip (Cambridge, MA: MIT Press, 2008), 373.

52. Lindsay Kelley, *Bioart Kitchen: Art, Feminism and Technoscience* (London: I. B. Tauris, 2016), 74.

53. Ahmed, *Living a Feminist Life*, 244.

54. Crys Moore, "Art in the After," *Art21 Magazine*, June 12, 2013, https://magazine.art21.org/2013/06/12/art-in-the-after/.

55. Boris Sokoloff, "The Problem of Cellular Anarchy," *Cancer Research* 11, no. 3 (1927): 246–281.

56. Ahmed reflects on the fragility of care and repair, observing that "the more careful you are, the more your hands tremble. . . . Perhaps to become careful, to be full of care, is to become anxious about the potential to break something else." Ahmed, *Living a Feminist Life*, 169.

57. "One afternoon I was having tea with one of the few friends who knew about my illness. We were talking about the future, when she said to me hesitantly, 'David, I have to ask you—what are you doing to treat your "terrain"?' She knew I didn't share her enthusiasm for herbal medicine and homeopathy. To me, this concept of 'terrain' (my lifestyle and environment taken as a holistic whole)—which I'd never heard of in medical school—was outside the confines of scientific medicine. I wasn't interested in the least. I told her that I had been very well looked after, and nothing remained to be done other than hope that the tumor wouldn't return. And I changed the subject." Servan-Schreiber, *Anticancer*, 114.

58. Eating well requires community support. Soon after that post, a collaborative meal delivery system was in place for da Costa, but when her building lost power during Hurricane Sandy, eating well became one of the most difficult things, without power, water, heat, or the capacity to walk fourteen flights of stairs. Beatriz da Costa, "No Sweet Talk This Time," *Beatriz Health and Life Update: Periodic Posts for Beatriz's Friends and Family* (blog), February 25, 2012, www.nideffer.net/beatriz_health_and_life_update/?p=153.

59. James Hamblin, "You Can't 'Starve' Cancer, but You Might Help Treat It with Food," *Atlantic*, May 21, 2019, https://www.theatlantic.com/health/archive/2019/05/food-cancer/589714/.

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60. Landecker, "Food as Exposure," 179.

61. Jain, *Malignant*, 85.

62. Ronald Broglio, *Surface Encounters: Thinking with Animals and Art* (Minneapolis: University of Minnesota Press, 2011), xvii.

## PART II

1. Howard Odum and Charles Hoskin, "Comparative Studies on the Metabolism of Marine Waters," *Institute of Marine Science* 5 (1958): 16.

2. Similar to Odum and Hoskin's community metabolism, "metabolic ecology" attends to energy flows between organisms and environments and scales up and down to accommodate the very large and very small. Scholars James Brown, Richard Sibly, and Astrid Kodric-Brown assert that "ecology is fundamentally metabolic" because "all ecological interactions involve exchanges of energy and materials." James Brown, Richard Sibly, and Astrid Kodric-Brown, *Metabolic Ecology: A Scaling Approach* (Hoboken, NJ: Wiley, 2012), 1.

3. Donna Haraway, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," *Feminist Studies* 14, no. 3 (1988): 575–599.

4. The Harrisons had a second work, *Artificial Aurora*, in the exhibition, which was curated by Maurice Tuchman. A highly technical collaboration with scientists from the Jet Propulsion Laboratory, the installation allowed visitors to walk among large glow-discharge chambers. Although *Shrimp Farm* was also a collaboration with scientists (Richard Eppley and Michael Mullen of the Scripps Institute of Oceanography Algology Group), the series of salt ponds was created "as an entry piece at a cost of approximately $800," while "our other work cost approximately $50,000." This work addressed the same questions about creating field paintings with light as the *Shrimp Farm*. Helen Mayer Harrison and Newton Harrison, *Shrimp Farm, Survival Piece #2: Notations of the Ecosystem of the Western Salt Works with the Inclusion of Brine Shrimp*, Harrison Studio, 1971, https://theharrisonstudio.net/shrimp-farm-survival-piece-2.

5. Harrison and Harrison, *Shrimp Farm, Survival Piece #2*.

6. Newton Harrison explains that "our decision was to deal with survival and to allow all the forms we used and all the activities we pursued to spring from that single decision," engaging "the idea that a single decision could generate a life's work." By the 1990s, the Harrisons had decided to only involve themselves in projects which "reverberate at least on continental levels." The *Survival Pieces* of the 1970s engage community metabolisms at a smaller scale, not yet continental, by introducing elements that would preoccupy the Harrisons throughout their careers: soil (*Hog Pasture: Survival Piece #1*, 1970–1971), waterways (*Portable Fish Farm: Survival Piece # 3*, 1971), and how people impact ecological systems (*Portable Orchard:*

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*Survival Piece #5*, 1972–1973, Orange County's last orange orchard). Craig Adcock, "Conversational Drift: Helen Mayer Harrison and Newton Harrison," *Art Journal* 51, no. 2 (1992): 35, 37.

7. Odum and Hoskin, "Comparative Studies on the Metabolism of Marine Waters," 16–17.

8. Adcock, "Conversational Drift," 37.

9. Adcock, "Conversational Drift," 37.

10. Scholar Melanie Dupuis contends that "we need to give up the idea that we are ingestive subjects, that a good life depends on maintaining boundaries of purity that make the false promise of safety." A distrust of digestion and defecation motivates ingestive subjects to pursue everything from dietary restrictions and eating disorders to "detox" purges and colonic irrigation. Dupuis argues for "digestive" instead of "ingestive" subjectivity. If ingestive subjects police what to allow in, digestive subjects manage what has arrived: "the digestive story is also about living with the choices already made," working against purity to create a world where "we can muddle through to a better but never perfect world, a fermentive, imperfect politics." Melanie Dupuis, *Dangerous Digestion: The Politics of American Dietary Advice* (Berkeley: University of California Press, 2015), 136, 148.

11. Rachel Lee, "Metabolic Aesthetics: On the Feminist Scentscapes of Anicka Yi," *Food, Culture and Society: An International Journal of Multidisciplinary Research* 22, no. 5 (2019): 4.

12. Paul Laster, "Anicka Yi, a Political Interview," Conceptual Fine Arts, May 2019, https://www.conceptualfinearts.com/cfa/2017/05/09/anicka-yi-and-her-political-statement-to-counter-the-ocular-centric-society-we-live-in-an-interview/.

13. Philosopher Alexis Shotwell argues for theories and practices that resist "purism" or "purity politics." For Shotwell, "that we are coconstituted and thus polluted and impure hails us to make continually contingent and unsettled decisions about how to be in relation to the world, with no predetermined answer." Alexis Shotwell, *Against Purity: Living Ethically in Compromised Times* (Minneapolis: University of Minnesota Press, 2016), 7, 10.

14. Heather Catchpole, "What Scat Is That?," ABC Science, September 26, 2007, https://www.abc.net.au/science/articles/2008/03/05/2044094.htm.

## CHAPTER 4

1. Research into long COVID patients suggests that impaired mitochondrial metabolic pathways (the site of ATP production) can produce fatigue. When ATP slows, bodies slow with it. Emily Wood, Katherine Hall, and Warren Tate, "Role of Mitochondria, Oxidative Stress and the Response to Antioxidants in Myalgic

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Encephalomyelitis / Chronic Fatigue Syndrome: A Possible Approach to SARS-CoV-2 'Long-Haulers?,'" *Chronic Diseases and Translational Medicine* 7, no. 1 (2021): 14–26.

2. Hannah Landecker, "Food as Exposure: Nutritional Epigenetics and the New Metabolism," *BioSocieties* (2011): 167–194.

3. Herman Pontzer, *Burn: The Misunderstood Science of Metabolism* (New York: Penguin, 2021), 50.

4. Thomas Pfeiffer and Annabel Morley, "An Evolutionary Perspective on the Crabtree Effect," *Frontiers in Molecular Biosciences* 1, no. 17 (2014): 1–6; Chao Liang et al., "Impacts of High ATP Supply from Chloroplasts and Mitochondria on the Leaf Metabolism of Arabidopsis Thaliana," *Frontiers in Plant Science* 6, no. 922 (2015): 1–17; Jerry Zimmerman, Amélie Saint André-von Arnim, and Jerry McLaughlin, "Cellular Respiration," in *Pediatric Critical Care*, ed. Jerry Zimmerman and Bradley Fuhrman, 4th ed. (Amsterdam: Elsevier, 2011), 1058–1072.

5. Howard Odum and Charles Hoskin, "Comparative Studies on the Metabolism of Marine Waters," *Institute of Marine Science* 5 (1958): 17.

6. Jacob Dunn and Michael Grider, "Physiology, Adenosine Triphosphate," in *StatPearls* (Treasure Island, FL: StatPearls, 2021), https://www.ncbi.nlm.nih.gov/books/NBK553175/; Susanna Törnroth-Horsefield and Richard Neutze, "Opening and Closing the Metabolite Gate," *PNAS* 105, no. 50 (2008): 19565; Nature Education, "ATP," Scitable, 2014, https://www.nature.com/scitable/definition/atp-318/; Genetic Science Learning Center, "ATP," Learn.Genetics, September 1, 2015, https://learn.genetics.utah.edu/content/metabolism/atp/; Zimmerman, Saint André-von Arnim, and McLaughlin, "Cellular Respiration," 1061; Koscak Maruyama, "The Discovery of Adenosine Triphosphate and the Establishment of Its Structure," *Journal of the History of Biology* 24, no. 1 (1991): 145–154.

7. "Currency, n," *OED*, 2021, https://www.oed.com/view/Entry/46095.

8. Pontzer, *Burn*, 50.

9. Genetic Science Learning Center, "ATP."

10. Nature Education, "ATP."

11. For Gómez-Barris, the extractive view, "similar to the colonial gaze, facilitates the reorganization of territories, populations, and plant and animal life into extractible data and natural resources for material and immaterial accumulation." Macarena Gómez-Barris, *The Extractive Zone: Social Ecologies and Decolonial Perspectives* (Durham, NC: Duke University Press, 2017), 5.

12. Barbara Montero, "Proprioception as an Aesthetic Sense," *Journal of Aesthetics and Art Criticism* 64, no. 2 (2006): 231–242.

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13. Karl Lohmann, "Über die Pyrophosphatfraktion im Muskel," *Die Naturwissenschaften* 17, no. 31 (1929): 624–625; Cyrus Fiske and Yellapragada Subbarow, "Phosphorus Compounds of Muscle and Liver," *Science* 70 (1929): 381–382; Fritz Schlenk, "The Ancestry, Birth and Adolescence of ATP," *Trends in Biochemical Sciences* 12 (1987): 367.

14. Schlenk, "The Ancestry, Birth and Adolescence of ATP," 367.

15. For more on the cultural history of umami, see Sarah E. Tracy, "Tasty Waste: Industrial Fermentation and the Creative Destruction of MSG," *Food, Culture and Society* 22, no. 5 (October 20, 2019): 548–565, https://doi.org/10.1080/15528014.2019.1638117.

16. "The initial products were isolated from muscle tissue and precipitated with ethanol. Currently, this product is isolated from a microbial source and is produced via a fermentation process." Sigma, "Adenosine 5'-Triphosphate Disodium Salt," accessed September 6, 2021, https://www.sigmaaldrich.com/deepweb/assets/sigmaaldrich/product/documents/415/339/a2383pis.pdf.

17. Lohmann, "Über die Pyrophosphatfraktion im Muskel."

18. Fiske and Subbarow, "Phosphorus Compounds of Muscle and Liver."

19. Marcel Florkin, *Comprehensive Biochemistry*, ed. Elmer Stotz and Marcel Florkin, vol. 31, *A History of Biochemistry Part III: History of the Identification of the Sources of Free Energy in Organisms* (Amsterdam: Elsevier, 1973), 124.

20. Fritz Lipmann, "Metabolic Generation and Utilization of Phosphate Bond Energy," in *Advances in Enzymology and Related Areas of Molecular Biology*, ed. F. F. Nord and C. H. Werkman (Hoboken, NJ: Interscience Publishers, 1941), 1:149.

21. Baljit Khakh and Geoffrey Burnstock, *The Double Life of ATP* (New York: Scientific American, 2009), 84.

22. Kathy Acker, "Against Ordinary Language: The Language of the Body," in *The Last Sex: Feminism and Outlaw Bodies*, ed. Arthur Kroker and Marilouise Kroker (New York: St. Martin's Press, 1993), 22.

23. Sue Kinnamon and Thomas Finger, "A Taste for ATP: Neurotransmission in Taste Buds," *Frontiers in Cellular Neuroscience* 7, no. 264 (2013): 1.

24. Törnroth-Horsefield and Neutze, "Opening and Closing the Metabolite Gate."

25. Lange-Berndt's "methodology of material complicity" arises in order "to give agency to the material, to follow the material and to act with the material." Petra Lange-Berndt, "Introduction: How to Be Complicit with Materials," in *Materiality*, ed. Petra Lange-Berndt (Cambridge, MA: MIT Press, 2015), 13, 15.

26. Gómez-Barris, *The Extractive Zone*, 5.

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27. Hannah Landecker, "Postindustrial Metabolism: Fat Knowledge," *Public Culture* 25, no. 3 (2013): 495.

28. Landecker describes how metaphors for metabolism have changed: "Metabolism no longer is seen as a factory . . . but has become a zone of regulation, a space for the integration and coordination of external and internal signals, whose timing is as important as their nature." Landecker, "Postindustrial Metabolism," 511.

29. Donna Haraway, *Crystals, Fabrics, and Fields: Metaphors That Shape Embryos* (New Haven, CT: Yale University Press, 1976), 5.

30. Donna Haraway, *Staying with the Trouble: Making Kin in the Chthulucene* (Durham, NC: Duke University Press, 2016), 12.

31. Amoeba Sisters, "What Is ATP?," YouTube, November 6, 2019, https://www.youtube.com/watch?v=23ZzI6WZS28.

32. Erik Knutzen, "Protein Synthesis: An Epic on the Cellular Level!," Root Simple, December 14, 2021, https://www.rootsimple.com/2021/12/protein-synthesis-an-epic-on-the-cellular-level/.

33. Benskian, "ATP Synthase: Represented through Human Movement," YouTube, March 25, 2015, https://www.youtube.com/watch?v=6QgmfcyIgp8.

34. Montero, "Proprioception as an Aesthetic Sense," 240.

35. Drew Berry and Justin Muir, "Synthesis of ATP," WEHI, 2018, https://www.wehi.edu.au/wehi-tv/synthesis-atp.

36. David Goodsell, Margaret Franzen, and Tim Herman, "From Atoms to Cells: Using Mesoscale Landscapes to Construct Visual Narratives," *Journal of Molecular Biology* 430, no. 21 (October 19, 2018): 3954–3968.

37. Drew Berry, "Animations of Unseeable Biology," TED, May 2011, https://www.ted.com/talks/drew_berry_animations_of_unseeable_biology/transcript.

38. Goodsell, Franzen, and Herman describe how animations like these continue a "strong tradition of cinematic techniques that guide viewers through a story." Goodsell, Franzen, and Herman, "From Atoms to Cells," 3960.

39. Berry, "Animations of Unseeable Biology."

40. Donna Haraway, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," *Feminist Studies* 14, no. 3 (1988): 575–599.

41. Goodsell, Franzen, and Herman, "From Atoms to Cells," 3955.

42. "While we cannot see small nanoscopic objects like proteins or other molecules, a common feature is their continuous motion, or vibration." Markus Buehler, "Liquified Protein Vibrations, Classification and Cross-Paradigm De Novo Image

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Generation Using Deep Neural Networks," *Nano Futures* 4, no. 3 (2020), https://dspace.mit.edu/handle/1721.1/132720.

43. Haraway, "Situated Knowledges."

44. Goodsell, Franzen, and Herman, "From Atoms to Cells," 3957.

45. Buehler, "Liquified Protein Vibrations, Classification and Cross-Paradigm De Novo Image Generation."

46. Buehler describes a process designed to "transform these molecular vibrations into vibrations of thin water films using acoustic actuators, leading to visual images of complex materialized patterns of surface waves." Buehler, "Liquified Protein Vibrations, Classification and Cross-Paradigm De Novo Image Generation."

47. Buehler's *Sonification of the Coronavirus Spike Protein (Amino Acid Scale)* (2020) and subsequent sonifications of mRNA vaccines have circulated widely during the pandemic, recalling Douglas Kahn's writing on the "viral tropes" of writer William Burroughs, where "viruses made sounds and were made of sounds." Douglas Kahn, *Noise Water Meat: A History of Sound in the Arts* (Cambridge, MA: MIT Press, 1999), 298.

48. Jenna Sutela and Markus Buehler, "Wet-on-Wet," *e-flux Architecture*, June 21, 2021, https://www.e-flux.com/architecture/survivance/390869/wet-on-wet/.

49. Sutela and Buehler, "Wet-on-Wet"; Caroline Jones, "Siren Songs," *e-flux Architecture*, June 23, 2021, https://www.e-flux.com/architecture/survivance/400172/siren-songs/.

50. Jones, "Siren Songs."

51. Sutela and Buehler, "Wet-on-Wet."

52. Hannah Higgins, *Fluxus Experience* (Berkeley: University of California Press, 2002), 34; Aristotle quoted in Korsmeyer, *Making Sense of Taste*, 19.

53. Georgina Born and Andrew Barry, "ART-SCIENCE: From Public Understanding to Public Experiment," *Journal of Cultural Economy* 3, no. 1 (2010): 116.

54. Katie Dyer and Lizzie Muller, "Objects, Energies and Curating Resonance across Disciplines," in *Curating Lively Objects: Exhibitions beyond Disciplines*, ed. Lizzie Muller and Caroline Seck Langill (New York: Routledge, 2022), 185.

55. Jim Elser and Phil Haygarth, *Phosphorus: Past and Future* (Oxford: Oxford University Press, 2020), 3.

56. On eating as politics and against purity, see Alexis Shotwell, "Flourishing Is Mutual: Relational Ontologies, Mutual Aid, and Eating," *Feminist Philosophy Quarterly* 7, no. 3 (2021): article 5.

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57. Katerina Teaiwa, "4. Islands. Colonialism and Geopolitics," *Technosphere Magazine*, November 15, 2016, https://technosphere-magazine.hkw.de/p/4-Islands-Colonialism-and-Geopolitics-dsR2t6QSVYLFyV3hHA4jHV.

58. Myra Hird, "Digesting Difference: Metabolism and the Question of Sexual Difference," *Configurations* 20, no. 3 (2012): 213–237.

59. Susan Iheagwara et al., "Phosphorus, Phosphorous, and Phosphate," *Hemodialysis International* 17, no. 4 (2013): 481.

60. Justus von Liebig, *Organic Chemistry in Its Application to Agriculture and Physiology* (London: Taylor and Walton, 1840).

61. John Bellamy Foster, "Marx's Theory of Metabolic Rift: Classical Foundations for Environmental Sociology," *American Journal of Sociology* 105, no. 2 (1999): 383.

62. Julia Rosen, "Humanity Is Flushing Away One of Life's Essential Elements," *Atlantic*, February 8, 2021, https://www.theatlantic.com/science/archive/2021/02/phosphorus-pollution-fertilizer/617937/.

63. Pontzer, *Burn*, 299.

64. Teaiwa, "4. Islands."

65. ANU Communications and Engagement, "Banaba's History of Exploitation on Display," Australian National University Newsroom, November 16, 2017, https://www.anu.edu.au/news/all-news/banaba%E2%80%99s-history-of-exploitation-on-display.

66. Katerina Teaiwa, *Consuming Ocean Island: Stories of People and Phosphate from Banaba* (Bloomington: Indiana University Press, 2014), 150–158.

67. Teaiwa, *Consuming Ocean Island*, 7–8.

68. Janice Cantieri, "Our Heart Is on Banaba: Stories from 'The Forgotten People of the Pacific,'" *National Geographic*, October 14, 2015, https://blog.nationalgeographic.org/2015/10/14/our-heart-is-on-banaba-stories-from-the-forgotten-people-of-the-pacific/.

69. Liebig, *Organic Chemistry in Its Application to Agriculture and Physiology*.

70. Teaiwa, "4. Islands."

71. Olivia Khoo, "A Post-Apology Carceral Regime: Encountering Refugee Art in Australia," *Australian Humanities Review* 61 (2017): 96.

72. Julia Morris, "Violence and Extraction of a Human Commodity: From Phosphate to Refugees in the Republic of Nauru," *Extractive Industries and Society* 6 (2019): 1126.

73. Talei Mangioni, "Confronting Australian Apathy: Latai Taumoepeau and the Politics of Performance in Pacific Climate Stewardship," *Contemporary Pacific* 33, no. 1 (2021): 44, 36.

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74. For Mangioni, Taumoepeau's "commanding" use of ice across her performances "signifies that the atrocities of climate change cannot be severed from past ecological extractivism." Mangioni, "Confronting Australian Apathy," 45.

75. Anote Tong, "Kiribati and Climate Change," in *Sustainability and the Rights of Nature in Practice*, ed. Cameron La Follette and Chris Maser (New York: Routledge, 2020), 83.

76. MTG Hawke's Bay, "MTG—Project Banaba by Katerina Teaiwa," YouTube, September 3, 2019, https://www.youtube.com/watch?v=iTiUOf0TaXI&t=1s.

77. Matthew Pasek and Dante Lauretta, "Aqueous Corrosion of Phosphide Minerals from Iron Meteorites: A Highly Reactive Source of Prebiotic Phosphorus on the Surface of the Early Earth," *Astrobiology* 5, no. 4 (2005): 533.

78. Michael Burton, "Astronomical Bodies," Michael Burton, 2010, http://www.michael-burton.co.uk/HTML/Astronomical%20BodiesTEXT1.htm.

79. Elser and Haygarth, *Phosphorus*, 8.

80. Benedict Singleton, "Anthropocene Nights," *Architectural Design* 82, no. 4 (2012): 70.

81. Monika Bakke, "Art and Metabolic Force in Deep Time Environments," *Environmental Philosophy* 14, no. 1 (2017): 45.

82. Elser and Haygarth, *Phosphorus*, 199.

83. Bakke, "Art and Metabolic Force in Deep Time Environments," 45.

84. Gómez-Barris, *The Extractive Zone*, 3–4.

85. Douglas Kahn, "What Is an Ecopath?," *Sydney Review of Books*, March 3, 2020, https://sydneyreviewofbooks.com/essay/what-is-an-ecopath/.

86. Dimitris Papadopoulos, María Puig de la Bellacasa, and Natasha Myers, "Elements: From Cosmology to Episteme and Back," in *Reactivating Elements: Chemistry, Ecology, Practice*, ed. Dimitris Papadopoulos, María Puig de la Bellacasa, and Natasha Myers (Durham, NC: Duke University Press, 2021), 6, 7.

87. Buehler, "Liquified Protein Vibrations, Classification and Cross-Paradigm de Novo Image Generation."

## CHAPTER 5

1. *Love Letters to Other Worlds* was an exhibition and performance event featuring artists Kathy High, Perdita Phillips, and myself. The exhibition followed a symposium at the University of Sydney's Sydney Environment Institute called "Hacking the Anthropocene: Feminist, Queer, and Anticolonial Propositions," convened by Astrida Neimanis and Jennifer Hamilton in 2016. Our working title was *Poop Circus*.

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High exhibited prints and sculptures from her series *Waste Matters: You Are My Future* (2015–2016), and Phillips performed with *Caution, Workers Below* (2016), a Ouija board modified to communicate with subterranean termites. I prepared and performed *Fecal Attraction Cocktails* (2016), a drink comprised of cold brew coffee, Kahlúa, and chocolate ice cream with a sweet corn garnish. The *Poop Circus* working title returns here to celebrate how excrement performs and entertains. Here's the recipe for *Fecal Attraction Cocktails*:

> Start with 3 parts cold brew coffee to 1 part Kahlúa in a large punch bowl
> Add to this base an appropriate amount of Benefiber supplement
> Ice, if desired
> Scoop chocolate ice cream on top
> Garnish with corn kernels
> Serving suggestion: lubricate your hands or gloves with vegetable shortening (I used an Australian brand, Copha), transferring the lube to serving glasses and onto other fingers

2. Ruben Meerman and Andrew J. Brown, "When Somebody Loses Weight, Where Does the Fat Go?," *BMJ* 349 (2014), https://doi.org/10.1136/bmj.g7257; Helen Pynor, "93% Human/Breathwork," World Science Festival Brisbane, June 2022, https://www.worldsciencefestival.com.au/curiocity-brisbane/93-human-breathwork.

3. Elizabeth Grosz, *Volatile Bodies: Toward a Corporeal Feminism* (St Leonards, NSW: Allen and Unwin, 1994), 81.

4. Cassils, "*$HT Coin* by Cassils (Aka: White Male Artist)," White Male Artist, July 23, 2021, https://whitemaleartist.com/.

5. Astrida Neimanis, *Bodies of Water: Posthuman Feminist Phenomenology* (London: Bloomsbury, 2016), 125.

6. Joseph Jenkins has authored the definitive North American guidebook to humanure composting. He describes the United States as "shit illiterate," for "any society that grows up with water toilets, also called flush toilets, seems to have an arrested development when it comes to the recycling of organic material, especially when it comes from its own bodies." Joseph Jenkins, *The Humanure Handbook: Shit in a Nutshell*, 4th ed. (Grove City, PA: Joseph Jenkins, Inc., 2019), 2, http://humanurehandbook.com/.

7. Piero Manzoni, *Artist's Shit*, 1961, edition of ninety tin cans, feces, 1.9 x 2.6 inches.

8. See, for example, Rain Embuscado, "A Brief History of Poop-Related Art: From Duchamp to Cattelan," *Artnet News*, May 2, 2016, https://news.artnet.com/art-world/human-waste-art-duchamp-cattelan-484562; Kathleen Ebbit, "Everybody Poops, but These Artists Made It into Masterpieces," Global Citizen, January 31, 2015, https://www.globalcitizen.org/en/content/this-art-is-shit-literally/. For a more scholarly treat-

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ment, see Jojada Verrips, "Excremental Art: Small Wonder in a World Full of Shit," *Journal of Extreme Anthropology* 1, no. 1 (2017): 19–46.

9. This approach to body process arguably returns in Delvoye's tattoo works, including *Tim* (2006). Wim Delvoye, "Tim," Wim Delvoye, 2006–2008, https://wimdelvoye.be/work/tattoo-works/tim.

10. RoseLee Goldberg, *Performance Art: From Futurism to the Present* (New York: Thames and Hudson, 2001), 148, 123.

11. "Record per 'Merda d'Artista' Di Manzoni: 275mila Euro per La Scatoletta n. 69," *La Stampa*, December 8, 2016, https://www.lastampa.it/cultura/2016/12/08/news/record-per-merda-d-artista-di-manzoni-275mila-euro-per-la-scatoletta-n-69-1.34752641.

12. Other significantly more expensive indulgences in the series include two different coke spoons, one with a McDonald's logo, and gold Nike Air Jordan 1 sneakers. Tobias Wong and Ken Courtney, *Indulgences: Gold Pills*, 2005, 24 karat gold leaf, gelatin capsule, three .75 inch pills, 2005, https://justanotherrichkid.com/collections/indulgences/products/indulgences-gold-pills?variant=4578753028.

13. Lisson Gallery, "Santiago Sierra—New Works," November 30, 2007, https://lisson-art.s3.amazonaws.com/uploads/attachment/file/body/471/SIER_2007.pdf.

14. Rose George, *The Big Necessity: Adventures in the World of Human Waste* (London: Portobello, 2008).

15. Composting toilets are the focus of *Glimpses of Poo-topia*, a work-in-progress that has produced several editions of a human manure zine as well as workshops and other public interventions. Lucas Ihlein et al., *Glimpses of Poo-topia*, 2021, http://www.pootopia.art/.

16. Jeremy Bellamy Foster's reading of Karl Marx and "metabolic rift" proposes that urban industrial centers divorced from agricultural production "prevent the return to the soil of its constituent elements consumed by man." Quoted in Jeremy Bellamy Foster, "Marx's Theory of Metabolic Rift: Classical Foundations for Environmental Sociology," *American Journal of Sociology* 105, no. 2 (1999): 379.

17. Wendy Vogel, "John Miller," Art in America, May 26, 2016, https://www.artnews.com/art-in-america/aia-reviews/john-miller-2-62184/.

18. Gelatin, *Vorm—Fellows—Attitude*, 2018, sculpture, carpets, and knitwear, https://www.gelitin.net/publications/Vorm-Fellows-Attitude/.

19. Jenny Percival, "Giant Dog Turd Wreaks Havoc at Swiss Museum," *Guardian*, August 12, 2008, https://www.theguardian.com/world/2008/aug/12/3.

20. Wikipedia tracks successful and unsuccessful attempts to urinate in installations of *Fountain* on the sculpture's dedicated web page. "*Fountain* (Duchamp)," Wikipedia, January 12, 2022, https://en.wikipedia.org/wiki/Fountain_(Duchamp)#Interventions.

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21. Bob Colacello, *Holy Terror: Andy Warhol Close Up* (New York: HarperCollins, 1990), 343.

22. Lucy Lippard, "Andres Serrano: The Spirit and the Letter," *Art in America* (April 1990): 239.

23. Mary Kelly, *Post-Partum Document* (New York: Routledge, 1983).

24. Laporte quotes psychoanalyst Jacques Lacan: "Civilization is the spoils: the *cloaca maxima*." Dominique Laporte, *History of Shit*, trans. Rodolphe el-Khoury and Nadia Benabid (Cambridge, MA: MIT Press, 2000), 14, 61, 56.

25. Daniel Gerling, "Excrementalisms: Revaluing What We Have Only Ever Known as Waste," *Food, Culture and Society* 22 (2019): 622, 634.

26. Laporte, *History of Shit*, 28.

27. Gerling, "Excrementalisms," 627.

28. Annemarie Mol, *Eating in Theory* (Durham, NC: Duke University Press, 2021), 138.

29. Gerling, "Excrementalisms," 627, 629; Laporte, *History of Shit*, 60.

30. Julia Kristeva, *Powers of Horror: An Essay on Abjection*, trans. Leon Roudiez (New York: Columbia University Press, 1982), 4, 3, 108, 2.

31. Simon Taylor, "The Phobic Object: Abjection in Contemporary Art," in *Abject Art: Repulsion and Desire in American Art*, by Jack Ben-Levi et al. (New York: Whitney Museum of American Art, 1995), 59.

32. Sociologist Imogen Tyler's critique of abjection focuses on the contrast between a theoretical abjection of maternal bodies (the separation from the mother being the primary abjection) and the very real violence experienced by pregnant women as a "consequence of being abject within specific social and political locations." Feminist theorist Deborah Caslav Covino "amends" abjection to account for plastic surgeries, where "parts of the body that should be amended" become "its abject objects." Imogen Tyler, "Against Abjection," *Feminist Theory* 10, no. 1 (2009): 77; Deborah Caslav Covino, *Amending the Abject Body: Aesthetic Makeovers in Medicine and Culture* (Albany: SUNY Press, 2004), 33.

33. This comment about abjection in the arts should not be read as totalizing. Kelly and many other artists engage deeply with psychoanalysis and its subtleties. Rather than single out individual exhibitions, curators, or artists, I signal that abjection and disgust have at times become synonymous in art writing, to the detriment of abjection's theoretical depth. Kristeva, *Powers of Horror*, 9.

34. Elizabeth Grosz, *Sexual Subversions: Three French Feminists* (London: Routledge, 1989), 71.

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35. Kristeva, *Powers of Horror*, 2.

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39. Heather Catchpole, "What Scat Is That?," ABC Science, September 26, 2007, https://www.abc.net.au/science/articles/2008/03/05/2044094.htm.

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45. Stephanie Springgay, "Bitter Chocolate Is for Adults! Matters of Taste in Elementary Students' Socially Engaged Art," in *Feltness: Research-Creation, Socially Engaged Art, and Affective Pedagogies* (Durham, NC: Duke University Press, 2022), 32.

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47. Springgay, "Bitter Chocolate Is for Adults!"

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53. Kristeva, *Powers of Horror*, 2.

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70. Guy Schaffer, "The History of Shit—the Forgotten Scatomancer: Challis Underdue's Excremental Vitality and the *Medical Cultures of Modern Great Britain*," You Are My Future, 2017, https://www.youaremyfuture.com/challis-underdue.

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biosystem with a more tolerant interpretation, situating even my ill health as part of a broader environmental entanglement." Kathy High, "Dear Bees and Microbes," in *Institutional Critique to Hospitality: Bioart Practice Now. A Critical Anthology*, ed. Assimina Kaniari (Athens: Grigori Publications, 2017).

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79. Mary Maggic, "All Washed Over by Hormones of Loving Grace," in *Plastic Ocean: Art and Science Responses to Marine Pollution*, ed. Ingeborg Reichle (Berlin: De Gruyter, 2021), 104.

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## CHAPTER 6

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2. Gilbert, "Holobiont by Birth," M73.

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22. Donna Haraway, *Staying with the Trouble: Making Kin in the Chthulucene* (Durham, NC: Duke University Press, 2016), 72.

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27. Jen Christiansen, "Visualizing Science: Illustration and Beyond," *Scientific American*, October 25, 2018, https://blogs.scientificamerican.com/sa-visual/visualizing-science-illustration-and-beyond/.

28. Sophia Roosth, *Synthetic: How Life Got Made* (Chicago: University of Chicago Press, 2017), 175, 176.

29. Natasha Myers, *Rendering Life Molecular: Models, Modelers, and Excitable Matter* (Durham, NC: Duke University Press, 2015), 5.

30. Myers, *Rendering Life Molecular*, 4, 1.

31. Myers describes a PhD student's spontaneous "molecular dance" during a routine lab meeting: "She lifted both her hands over her head and traced the winding backbones of the twinned molecules, one with each hand, following them as they traversed extracellular and intracellular spaces. Her gestures were large and sweeping: she brought her arms high up over her head, all the way down over her body. Her molecular dance ended with her fully bent over, hands touching the floor." Myers, *Rendering Life Molecular*, 219–223, 215, 218.

32. Barbara Montero, "Proprioception as an Aesthetic Sense," *Journal of Aesthetics and Art Criticism* 64, no. 2 (2006): 240.

33. Kat Jungnickel, "Introducing," in *Transmissions: Critical Tactics for Making and Communicating Research*, ed. Kat Jungnickel (Cambridge, MA: MIT Press, 2020), 3.

34. This question of compelling exceptions could be another book and probably is. Crowdsourced public science projects could be read alongside the rise in participatory art, but usually public and crowdsourced science generates data but does not necessarily present findings back to the scientific community while in the act of engaging the public. Da Costa's *Pigeon Blog* is a notable exception to this. See Beatriz da Costa, "Reaching the Limit: When Art Becomes Science," in *Tactical Biopolitics: Art, Activism, and Technoscience*, ed. Beatriz da Costa and Kavita Philip (Cambridge, MA: MIT Press, 2008). The Tissue Culture and Art Project was cited in the journal *Tissue Engineering*, another instance of art research questions directly informing science research questions. I discuss the significance of this citation in Lindsay Kelley, *Bioart Kitchen: Art, Feminism and Technoscience* (London: I. B. Tauris, 2016), 88–89. For an example of a mixed methods event designed to present findings, see the "Embodied" issue of *SciArt Magazine*'s "Movement" volume, which features performances

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combining drawing, music, and biology as well as online dance collaborations. "Movement, Embodied," SciArt Initiative, 2021, https://www.sciartmagazine.com/movement-embodied.html. And finally the Science Gallery Network (or movement) stages work that often blurs boundaries between art research and science research questions. "The Science Gallery Network," accessed February 21, 2023, https://sciencegallery.org/.

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36. Yonetani and Yonetani, *Dysbiotica*, 112, 113.

37. Triennial staff, "Dreaming with: Ken + Julia Yonetani," Asia Society / Triennial, February 11, 2021, https://asiasociety.org/triennial/updates/dreaming-ken-julia-yonetani.

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39. Haraway, *Staying with the Trouble*, 72.

40. Gilbert, Sapp, and Tauber, "A Symbiotic View of Life," 335, 336, 326.

41. Eva Hayward, "Sensational Jellyfish: Aquarium Affects and the Matter of Immersion," *Differences: A Journal of Feminist Cultural Studies* 23, no. 5 (2012): 177.

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44. Mielle Chandler and Astrida Neimanis, "Water and Gestationality: What Flows beneath Ethics," in *Thinking with Water*, ed. Cecilia Chen, Janine MacLeod, and Astrida Neimanis (Montreal: McGill–Queen's University Press, 2013), 61–83; Neimanis, *Bodies of Water*, 102.

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48. Donna Haraway, "Ecce Homo. Ain't (Ar'n't) I a Woman, and Inappropriate/d Others: The Human in a Post-Humanist Landscape," in *The Haraway Reader* (New York: Routledge, 2004), 47; Barad, "Posthumanist Performativity."

49. Wertheim and Wertheim, "The Institute for Figuring."

50. Margaret Wertheim and Christine Wertheim, *Crochet Coral Reef: A Project by the Institute for Figuring* (Los Angeles: Institute for Figuring, 2015), 18.

51. My first encounter with the *Crochet Coral Reef* was the *Denver Satellite Reef*, created and displayed at the Denver Art Museum in 2013. Works from the *Crochet Coral Reef* core collection accompanied the satellite reef in an exhibition called *SPUN: Adventures in Textiles*. The IFF highlights how the project progresses despite the COVID-19 pandemic. Its distributed structure and portability allow makers to continue working through lockdowns and other disruptions. Institute for Figuring, "Satellite Reefs," Crochet Coral Reef, accessed March 9, 2023, https://crochetcoralreef.org/satellitereefs/.

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53. Scott East, "Museum Affect: Crocheted Coral, Children's Stories and Possibilities in Queer Time," in *Climate Change and Museum Futures*, ed. Fiona Cameron and Brett Neilson (London: Routledge, 2014), 233.

54. Stefan Helmreich, *Sounding the Limits of Life: Essays in the Anthropology of Biology and Beyond* (Princeton, NJ: Princeton University Press, 2016), 52.

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58. Quoted in Sophia Roosth, "Evolutionary Yarns in Seahorse Valley: Living Tissues, Wooly Textiles, Theoretical Biologies," *Differences: A Journal of Feminist Cultural Studies* 23, no. 3 (2012): 28.

59. Margaret Wertheim quoted in Roosth, "Evolutionary Yarns in Seahorse Valley," 31.

60. Quoted in Wertheim and Wertheim, *Crochet Coral Reef*, 143–144.

61. Wertheim and Wertheim, *Crochet Coral Reef*, 139.

62. Margaret Wertheim, "How to Play Mathematics," *Aeon*, February 7, 2017, https://aeon.co/essays/theres-more-maths-in-slugs-and-corals-than-we-can-think-of.

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66. Helmreich, *Sounding the Limits of Life*, 52.

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